

DEPARTMENT OF ENERGY
FY 1999 CONGRESSIONAL BUDGET REQUEST
DEFENSE ENVIRONMENTAL RESTORATION AND WASTE MANAGEMENT
(Tabular dollars in thousands, narrative in whole dollars)

SCIENCE AND TECHNOLOGY DEVELOPMENT

PROGRAM MISSION

The Office of Environmental Management (EM) faces technical and fiscal challenges that, without new or alternative technologies, present serious obstacles to the rapid and cost-effective cleanup of the DOE complex. The Office of Science and Technology (OST) provides new or improved technologies and research results that reduce risks to workers, the public, and the environment; reduce cleanup costs; and/or provide solutions to environmental problems that currently have no solutions. The sites' Draft 2006 Plan submissions contained over 500 technology needs that must be addressed in order to accomplish cleanup within the next decade. The estimated potential cost avoidance in the Draft 2006 Plan from the use of new technology is \$12 to \$27 billion, on which EM is relying to accomplish the Draft 2006 Plan goals. Of the identified needs, 160 can be met using technologies already fully demonstrated, and OST is currently working on 250 that, if funded through fruition, will be ready for use to meet the Draft 2006 Plan goals. Technologies can enter OST's developmental process anywhere in the developmental "pipeline." Preference is given to technologies in a mature state for OST to demonstrate viability on DOE's environmental problems. This decreases development costs and gets technology to the user faster. The technology development process is considered complete and successful when a technology has been field-tested on actual waste, proves to be an improvement over conventional methods, and meets all requirements of applicable environmental laws and regulations.

The OST Science program works with the EM programs and DOE sites to develop and implement a targeted scientific research agenda which focuses on EM's most intractable problems. The Risk Policy Program supports evaluation and consideration of environmental and health risks in EM priority setting and decision making.

Congress has expressed concern with the rate at which new technology is used in actual cleanup projects. EM has implemented a ten-point action plan that established a new oversight mechanism, re-engineers OST business management processes, and establishes tools to aggressively accelerate widespread deployment of the new technology in which it invests. This budget reflects input from and funding decisions made by this new EM corporate leadership committee, the Technology Acceleration Committee, which consists of senior DOE field and headquarters EM line-organization management.

PROGRAM MISSION - SCIENCE AND TECHNOLOGY DEVELOPMENT - DEFENSE (cont'd)

Uncertainties are inherent in any research program, and the allocations of funding requested represent the best estimates at the time this budget was formulated. It is possible that as circumstances change, priorities could change as well, and it may be necessary to redirect funds within the Technology Development program categories.

Environmental Management's major environmental problems have been identified and are the focus of scientific research, technology development and deployment. Referred to as Focus Areas, these teams manage research, development and demonstrations of alternative technology, as well as providing deployment assistance and technical advice to the user communities.

- Mixed Waste Characterization, Treatment and Disposal to address the large inventory of mixed, low-level, and transuranic waste;
- Radioactive Tank Waste Remediation to address the hundreds of large storage tanks containing over 100 million gallons of radioactive waste;
- Subsurface Contaminants to address hazardous and radioactive contaminants in soil and ground water and to address the migration and remediation challenges posed by numerous DOE landfills;
- Deactivation and Decommissioning to transition, deactivate, decommission, and dispose of the aging and contaminated DOE weapons complex facilities; and,
- Plutonium Stabilization and Disposition (new Focus Area in the OST FY 1999 budget previously funded through the EM Office of Nuclear Materials and Facility Stabilization) to address the over 20 tons of excess plutonium that must be stabilized.

In FY 1999, crosscutting programs (such as Characterization, Efficient Separations, Robotics, and Industry Programs) are now integrated into the Focus Areas, rather than as separate programs.

Office of Science and Technology budget structure is organized around the following:

- **Environmental Management Science Program**, a scientific research program that is fully integrated into and operates in tandem with the established Focus Areas, which provide the mechanism for translating scientific research into applicable technologies. EM's risk policy and research activities, which are also conducted in this budget structure element, provide the analytical framework and technical support necessary for informed priority setting and credible decision making.

PROGRAM MISSION - SCIENCE AND TECHNOLOGY DEVELOPMENT - DEFENSE (cont'd)

- **Technology Development and Deployment**, encompasses the applied research and development activities that demonstrate the viability of alternative technologies through the Focus Areas and University Programs and activities which facilitate site acceptance and use of emerging and available alternative technologies.
- **Technology Acceptance and Support (previously known as Technology Systems Applications)** activities ensure technologies which are still in development are ultimately accepted by all parties and used by the DOE sites. In addition, funding for the SBIR assessment in accordance with Public Law 102-564 is also included.

Within the Focus Areas' FY 1999 budget requests, efforts will continue to accelerate the widespread deployment of currently available technologies by helping to fund the first application of high-payoff, competitively selected technologies that meet a multi-application performance specification. These successful applications will eliminate the perceived business risks associated with new technology and will result in deployment (used at multiple sites). The requested funds will address another 250 needs with technologies that are currently in late stages of the developmental pipeline and, are planned for readiness to contribute to cost reduction in the Draft 2006 Plan window.

Over the past several years, OST activities have become closely linked with major ongoing compliance-driven EM cleanup projects. For example, OST has partnered technically and financially with the Office of Environmental Restoration in the cocooning of the Hanford C-Reactor, and dislodging and removing waste from the Gunite Tanks at Oak Ridge; and in the Hanford Tank Initiative with the Office of Waste Management.

Performance Measures

In FY 1999, OST success will be measured by: 1. Demonstrating 22 alternative technology systems that meet performance specification-based needs as identified by the Site Technology Coordinating Groups (STCGs); and 2. Making 40 alternative technology systems available for implementation with cost and engineering performance data. EM in FY 1999, has established a corporate performance goal of 60 deployments of alternative technologies in actual cleanup projects. Technology selections are made by EM user programs, such as, Environmental Restoration and Waste Management.

DEPARTMENT OF ENERGY
FY 1999 CONGRESSIONAL BUDGET REQUEST
DEFENSE ENVIRONMENTAL RESTORATION AND WASTE MANAGEMENT
(Tabular dollars in thousands, narrative in whole dollars)

SCIENCE AND TECHNOLOGY DEVELOPMENT

PROGRAM FUNDING PROFILE

	FY 1997 Adjusted <u>Appropriation</u>	FY 1998 Adjusted <u>Appropriation</u>	FY 1999 Budget <u>Request</u>
TECHNOLOGY DEVELOPMENT AND DEPLOYMENT			
Mixed Waste Characterization, Treatment and Disposal	\$66,014	\$37,879	\$20,835
Radioactive Tank Waste Remediation	54,905	53,982	45,885
Subsurface Contaminants	57,556	32,970	31,700
Deactivation and Decommissioning	30,192	28,485	20,845
Plutonium Stabilization and Disposition	0	0	4,935
University Programs	21,930	22,150	14,900
Idaho Technology Validation and Verification Center (ITVVC)	4,000	14,500	0 ¹
Western Environmental Technology Office (WETO)	<u>13,463</u>	<u>13,363</u>	<u>0¹</u>
Subtotal, Technology Development and Deployment	\$248,060	\$203,329	\$139,100

¹ Funding request for these activities is contained within the Science and Technology Development decision unit under the Non-Defense EM appropriation.

SCIENCE AND TECHNOLOGY DEVELOPMENT - DEFENSE (cont'd)

PROGRAM FUNDING PROFILE - (cont'd)

	FY 1997 Adjusted <u>Appropriation</u>	FY 1998 Adjusted <u>Appropriation</u> ²	FY 1999 Budget <u>Request</u> ²
TECHNOLOGY ACCEPTANCE AND SUPPORT			
Technology Acceptance and Support	43,059	12,871	14,900
Small Business Innovative Research Program	<u>0</u> ³	<u>3,800</u>	<u>2,000</u>
Subtotal, Technology Acceptance and Support . .	\$43,059	\$16,671	\$16,900
 SUBTOTAL, TECHNOLOGY DEVELOPMENT .	 \$291,119	 \$220,000	 \$156,000
SCIENCE AND RISK POLICY PROGRAM			
Science	48,675	46,110 ⁴	31,158
Small Business Innovative Research Program	0 ⁵	1,212	842
Risk Policy	<u>12,124</u>	<u>7,000</u>	<u>5,000</u>
SUBTOTAL, SCIENCE AND RISK POLICY PROGRAM	\$60,799	\$54,322	\$37,000
 TOTAL, SCIENCE AND TECHNOLOGY DEVELOPMENT ⁶	 <u>\$351,918</u> ⁷	 <u>\$274,322</u>	 <u>\$193,000</u>

² Final distribution of funds by program category in FY 1998 and FY 1999 could change based upon changing priorities, and final receipt, review, selection, and award of technical proposals.

³ Excludes \$4,095,000 transferred to DOE Office of Energy Research for administration of SBIR grants.

⁴ Excludes \$678,000 for general reduction to FY 1998 Defense EM appropriation.

⁵ Excludes \$1,325,000 transferred to DOE Office of Energy Research for administration of SBIR grants.

⁶ Includes capital equipment estimates of \$3,100,000 for FY 1997; \$3,000,000 for FY 1998; and \$2,500,000 for FY 1999.

⁷ Reflects FY 1997 new Budget Authority reduction of \$8,568,001 which was utilized for the prior year offset to the FY 1997 EM Appropriation.

SCIENCE AND TECHNOLOGY DEVELOPMENT - DEFENSE (cont'd)

PROGRAM FUNDING PROFILE - (cont'd)

Public Law 95-91; Department of Energy Organization Act of 1977

Public Law 105-62; Energy and Water Development Appropriations Act, Fiscal Year 1998

Public Law 105-340; National Defense Authorization Act of FY 1998

DEPARTMENT OF ENERGY
FY 1999 CONGRESSIONAL BUDGET REQUEST
DEFENSE ENVIRONMENTAL RESTORATION AND WASTE MANAGEMENT
(Tabular dollars in thousands, narrative in whole dollars)

SCIENCE AND TECHNOLOGY DEVELOPMENT

PROGRAM FUNDING BY SITE

	<u>FY 1997 Adjusted Appropriation</u>	<u>FY 1998 Adjusted Appropriation</u>	<u>FY 1999 Budget Request</u>
ALBUQUERQUE OPERATIONS OFFICE			
Los Alamos National Laboratory (NM)	\$9,767	\$7,596	\$350
Sandia National Laboratory (CA)	1,483	348	0
Sandia National Laboratory (NM)	10,360	5,600	1,500
Lovelace Biomedical and Environmental Research Institute (CO)	1,234	450	0
Mid-West Research Institute (CO)	294	210	0
Albuquerque Operations Office (NM)	<u>6,561</u>	<u>12,545</u>	<u>12,239</u>
Subtotal, ALBUQUERQUE	\$29,699	\$26,749	\$14,089
CARLSBAD AREA OFFICE			
Carlsbad Area Office (NM)	\$0	\$0	\$5,000
CHICAGO OPERATIONS OFFICE			
Ames Laboratory (IA)	1,073	930	0
Argonne National Laboratory (West) (ID)	13,130	5,486	0
Brookhaven National Laboratory (NY)	2,033	1,870	0
Chicago Operations Office (IL)	<u>7,365</u>	<u>5,025</u>	<u>6,440</u>
Subtotal, CHICAGO	\$23,601	\$13,311	\$6,440

SCIENCE AND TECHNOLOGY DEVELOPMENT - DEFENSE (cont'd)

PROGRAM FUNDING BY SITE (cont'd)

	FY 1997 Adjusted <u>Appropriation</u>	FY 1998 Adjusted <u>Appropriation</u>	FY 1999 Budget <u>Request</u>
IDAHO OPERATIONS OFFICE			
Idaho National Engineering and Environmental Laboratory (ID)	21,563	24,431	0
Idaho Operations Office (ID)	<u>40,125</u>	<u>23,280</u>	<u>47,989</u>
Subtotal, IDAHO	\$61,688	\$47,711	\$47,989
FEDERAL ENERGY TECHNOLOGY CENTER (FETC)			
West Virginia	84,366	62,035	45,112
Pennsylvania	<u>13,463</u>	<u>13,363</u>	<u>0</u>
Subtotal, FEDERAL ENERGY TECHNOLOGY CENTER (FETC)	\$97,829	\$75,398	\$45,112
NEVADA OPERATIONS OFFICE			
Nevada Operations Office (NV)	\$5,021	\$4,213	\$8,990
OAK RIDGE OPERATIONS OFFICE			
Oak Ridge National Laboratory (TN)	27,513	19,569	0
Oak Ridge Inst. For Science and Education (TN) . .	703	508	0
Oak Ridge Operations Office (TN)	<u>5,869</u>	<u>10,182</u>	<u>2,362</u>
Subtotal, OAK RIDGE	\$34,085	\$30,259	\$2,362
OAKLAND OPERATIONS OFFICE			
Lawrence Berkeley National Laboratory (CA)	4,369	3,812	0
Lawrence Livermore National Laboratory (CA) . . .	5,760	4,042	0
Oakland Operations Office (CA)	<u>786</u>	<u>155</u>	<u>240</u>
Subtotal, OAKLAND	\$10,915	\$8,009	\$240

IENCE AND TECHNOLOGY DEVELOPMENT - DEFENSE (cont'd)

PROGRAM FUNDING BY SITE (cont'd)

	FY 1997 Adjusted <u>Appropriation</u>	FY 1998 Adjusted <u>Appropriation</u>	FY 1999 Budget <u>Request</u>
OHIO OPERATIONS OFFICE			
Fernald Environmental Management			
Project (OH)	6,569	1,109	0
Ohio Operations Office (OH)	<u>150</u>	<u>4,982</u>	<u>240</u>
Subtotal, OHIO	\$6,719	\$6,091	\$240
RICHLAND OPERATIONS OFFICE			
Pacific Northwest National Laboratory (WA)	29,258	18,843	0
Westinghouse Hanford Corporation (WA)	743	0	0
Richland Operations Office (WA)	<u>13,358</u>	<u>12,022</u>	<u>35,377</u>
Subtotal, RICHLAND	\$43,359	\$30,865	\$35,377
ROCKY FLATS OFFICE			
Kaiser Hill (CO)	1,280	250	0
Rocky Flats Office (CO)	<u>950</u>	<u>3,200</u>	<u>240</u>
Subtotal, ROCKY FLATS	\$2,230	\$3,450	\$240
SAVANNAH RIVER OPERATIONS OFFICE			
Savannah River Site (SC)	13,687	7,797	0
Savannah River Operations Office (SC)	<u>2,687</u>	<u>1,571</u>	<u>23,471</u>
Subtotal, SAVANNAH RIVER	\$16,374	\$9,368	\$23,471

SCIENCE AND TECHNOLOGY DEVELOPMENT - DEFENSE (cont'd)

PROGRAM FUNDING BY SITE (cont'd)

	FY 1997 Adjusted <u>Appropriation</u>	FY 1998 Adjusted <u>Appropriation</u>	FY 1999 Budget <u>Request</u>
HEADQUARTERS	\$20,398	\$18,898	\$3,450
TOTAL, SCIENCE AND TECHNOLOGY DEVELOPMENT	<u>\$351,918</u>	<u>\$274,322</u>	<u>\$193,000</u> ¹

¹ FY 1999 funding will be held at the lead Field Office and will be distributed early in FY 1999 based on review and acceptance of FY 1999 Technical Task Plan (TTP) proposals and competitive solicitations among laboratories, universities and industry.

SCIENCE AND TECHNOLOGY DEVELOPMENT

TECHNOLOGY DEVELOPMENT AND DEPLOYMENT

FY 1999 CONGRESSIONAL BUDGET THEMES

	<u>FY 1997</u>	<u>FY 1998</u>	<u>FY 1999</u>
<u>MIXED WASTE CHARACTERIZATION, TREATMENT AND DISPOSAL FOCUS AREA</u>	\$66,014	\$37,879	\$20,835

The Mixed Waste Characterization, Treatment and Disposal Focus Area (MWFA) develops and demonstrates technologies to deal with 175,000 cubic meters of stored mixed low-level and transuranic wastes from over 1,400 waste streams at 40 sites and provides technology validation and verification to provide sound bases for increased application of innovative technologies. Within the funding provided, this Focus Area will assist individual sites in the deployment of alternative technologies to reduce risk and cost, and accelerate the cleanup at those sites. The MWFA includes the following systems:

Non-Thermal Treatment Systems (FY 1999 funding \$6.0 million) are being developed to address regulatory and public concerns over any high-temperature process.

Handling and Non-Destruction Evaluation of Mixed and TRU Waste (FY 1999 funding \$5.2 million) systems are being developed to avoid the cost and risk associated with opening, sampling, and analyzing waste drum contents.

Thermal Treatment Systems (FY 1999 funding \$4.6 million) are being readied for use within the DOE complex. Prior to implementation, radionuclide partitioning in the treatment system effluents must be determined to validate system performance. Focus will be on development of continuous emission monitoring instruments and techniques to destroy products in incomplete combustion.

Transuranic Waste Technologies (FY 1999 funding \$5.0 million) for partial treatment of transuranic waste are being developed and deployed to allow packaging and shipment of waste to the Waste Isolation Pilot Plant (WIPP) for permanent disposal.

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

FY 1999 CONGRESSIONAL BUDGET THEMES

	<u>FY 1997</u>	<u>FY 1998</u>	<u>FY 1999</u>
<u>RADIOACTIVE TANK WASTE REMEDIATION</u>			
<u>FOCUS AREA</u>	\$54,905	\$53,982	\$45,885

The Radioactive Tank Waste Remediation Focus Area (TFA) addresses development and deployment of technologies to remove high-level waste (HLW) in tanks across DOE, and to prepare it for final disposal. Closure of the high-level radioactive waste tanks will mitigate further risks to ground water and surrounding populations, and will contribute significantly to mortgage reduction. Within the funding provided, this Focus Area will assist individual sites in the deployment of alternative technologies to reduce risk and cost, and accelerate the cleanup at those sites. The TFA includes the following activities:

Hanford Tank Initiative (FY 1999 funding \$10.0 million), a five-year project that began in FY 1997, employing performance-based contracts, is using two high-level waste tanks at the Hanford site as full-scale test beds to determine the waste retrieval costs, define schedules and risks, establish an acceptable remediation approach, define an acceptable end-state for tank closure, demonstrate residual waste characterization, and obtain acceptance of regulatory agencies and stakeholders. This initiative directly supports the retrieval aspects of Tank Waste Remediation System (TWRS) Privatization, Phase II.

Tank Waste Retrieval and Closure (FY 1999 funding \$19.8 million) techniques will be developed to mobilize and retrieve mixtures of hard deposits, sludges, and debris from the tanks for further processing and to reduce secondary waste generation during retrieval.

Pretreatment and Immobilization (FY 1999 funding \$16.1 million) technologies will be developed to condition liquids, sludges, and hard deposits to meet treatment specifications and then to immobilize this waste for safe disposal in support of privatization activities. Monitors will be validated to ensure that retrieved wastes meet treatment system feed specifications.

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

FY 1999 CONGRESSIONAL BUDGET THEMES

	<u>FY 1997</u>	<u>FY 1998</u>	<u>FY 1999</u>
<u>SUBSURFACE CONTAMINANTS FOCUS AREA</u>	\$57,556	\$32,970	\$31,700

The Subsurface Contaminants Focus Area (SCFA) addresses technological solutions for the 5,700 known DOE ground water plumes that involve 600 billion gallons of water and 200 million cubic meters of soil. The SCFA currently encompasses three problem areas, organic solvent remediation, containment (barriers caps and covers), and metals and radionuclide plumes. Within the funding provided, this Focus Area will assist individual sites in the deployment of alternative technologies to reduce risk and cost, and accelerate cleanup at those sites. The SCFA includes the following activities:

Dense Non-Aqueous Phase Liquids (DNAPLs) (FY 1999 funding \$13.6 million) are extremely problematic because they are hard to locate, quantify and move to the subsurface. Therefore, work will continue validating DNAPL delineation technologies and developing alternative in situ remediation technologies in cooperation with the Office of Environmental Restoration, concentrating efforts on deep installation, verification, and monitoring.

Landfill Treatment and Contamination (FY 1999 funding \$8.0 million) technologies need to be developed to prevent the spread of contamination of ground water in the proximity of landfills. Data to support the revision of current EPA landfill cover design guidance will be delivered to EPA; an open procurement for the demonstration of deep barrier installation technology will be initiated; and hot spot remediation technologies will be implemented at a selected DOE site.

Radionuclide and Other Materials in Soils (FY 1999 funding \$10.1 million) technologies will be implemented for the deep emplacement of reactive barriers with innovative contaminant capture materials for toxic heavy metal and radionuclide remediation. Contaminant removal techniques which adsorb or chemically bind these contaminants will also be implemented to improve removal efficiency.

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

FY 1999 CONGRESSIONAL BUDGET THEMES

	<u>FY 1997</u>	<u>FY 1998</u>	<u>FY 1999</u>
<u>DEACTIVATION AND DECOMMISSIONING</u>			
<u>FOCUS AREA</u>	\$30,192	\$28,485	\$20,845

The Deactivation and Decommissioning Focus Area (DDFA) develops, demonstrates, and facilitates implementation and deployment of efficient and cost effective technologies through a series of Large Scale Demonstration Projects (LSDP) which address real needs pertaining to the over 7,000 radiologically contaminated buildings and facilities. The goal is to provide capabilities, by the end of year 2000, to deactivate and decommission 90 percent of surplus facilities and materials. Within the funding provided, this Focus Area will assist individual sites in the deployment of alternative technologies to reduce risk and cost, and accelerate the cleanup at those sites. The LSDPs include:

Highly Enriched Uranium Contaminated Facility D&D (FY 1999 funding \$6.0 million). Demonstrate at full-scale and assist deployment of innovative characterization and remote decontamination and dismantlement technologies for safe and cost-effective deactivation of HEU contaminated facilities at the Savannah River Site, yielding an approximate savings of \$20 million in surveillance and maintenance and material control and accountability costs for this facility alone, with additional deployment and savings opportunities at all DOE sites.

Transuranic Contaminated Materials and Waste Disposition (FY 1999 funding \$6.0 million). Demonstrate at full-scale and assist deployment of innovative characterization, segregation, decontamination, waste minimization and packaging technologies for TRU waste at Los Alamos National Laboratory (LANL) to improve the efficiency and human health and safety of such operations, yielding an approximate savings of \$80-\$175 million in WIPP TRU waste disposal cost at LANL alone, with additional deployment and savings opportunities at several sites, especially Rocky Flats.

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

FY 1999 CONGRESSIONAL BUDGET THEMES

Deactivation and Decommissioning Focus Area - (cont'd)

Canyons Disposition Initiative (FY 1999 funding \$3.0 million). Conduct preliminary planning and identify technologies to determine the preferred final end state (set the ROD) for five chemical processing facilities (canyons) at Hanford, potentially using them for waste disposal, which can save approximately \$1.1 billion in future D&D and waste disposal costs at Hanford with additional deployment and savings opportunities at Savannah River, Idaho and Oak Ridge.

Tritium Contaminated Facility D&D (FY 1999 funding \$5.8 million). Demonstrate at full-scale and assist deployment of innovative cost-effective technologies for characterization, decontamination and dismantlement of tritium-contaminated facilities at Mound, yielding an approximate cost savings of \$25 million at Mound with additional deployment and savings opportunities at other sites, including Savannah River.

	<u>FY 1997</u>	<u>FY 1998</u>	<u>FY 1999</u>
<u>PLUTONIUM STABILIZATION AND DISPOSITION FOCUS AREA</u>	\$0	\$0	\$4,935

The Plutonium Stabilization and Disposition Focus Area (PFA) is a new (OST) start in FY 1999 that will respond to Secretary of Energy commitments to Defense Nuclear Facility Safety Board (DNFSB) recommendations.

Stabilization and Disposition of Plutonium (FY 1999 funding of \$4.9 million) will develop improved processes to stabilize plutonium (more than 20 tons) left in the weapons production pipelines in various storage configurations and plutonium residues (170 tons) and develop disposition technologies to fabricate Pu residue package containers from large DOE inventory of radioactive contaminated scrap metal and remote packaging and non-intrusive package monitoring systems.

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

FY 1999 CONGRESSIONAL BUDGET THEMES

	<u>FY 1997</u>	<u>FY 1998</u>	<u>FY 1999</u>
<u>UNIVERSITY PROGRAMS</u>	\$21,930	\$22,150	\$14,900

Universities provide a unique opportunity to cooperate with the academic community in the development of fundamental data related to the application of technology development and the follow-up activities related to the resolution of technical issues and system optimization. Attention is given to providing credible data, from non-conflicted, recognized experts in support of activities related to the acceptance of innovative technologies by the regulators and stakeholders.

Florida State University (FY 1999 funding \$1.9 million) in partnership with Eastern and Central European Institutes are evaluating the transfer of European technologies to solve DOE cleanup problems.

Mississippi State University (FY 1999 funding \$4.0 million) continues its support to the Focus Areas in the development of monitors for thermal treatment of mixed waste and develop sensors to measure high-level waste in transfer pipes.

Florida International University (FY 1999 funding \$5.0 million) is initiating a program to improve Robotic decontamination and decommissioning equipment that will be used in highly radioactive environments.

Robotics University Program (FY 1999 funding \$4.0 million) is supporting deactivation and decommissioning efforts for mapping of facilities and the remote handling of materials.

	<u>FY 1997</u>	<u>FY 1998</u>	<u>FY 1999</u>
<u>TECHNOLOGY ACCEPTANCE AND SUPPORT</u>	\$43,059	\$12,871	\$14,900

The Technology Acceptance and Support program supports the early acceptance of technologies in the developmental pipeline, ultimately expediting technology deployment and thus serving mortgage reduction and other Draft 2006 Plan goals. This is done by improving internal decision making and strengthening involvement of site problem holders, regulators, other decision makers and stakeholders.

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

FY 1999 CONGRESSIONAL BUDGET THEMES

Technology Acceptance and Support - (cont'd)

Program Information, Review, and Analysis (FY 1999 funding \$4.5 million) ensures that the most competitive, effective, and user-needed technologies are identified. OST technologies are aligned with the Draft 2006 Plan requirements through analysis and articulation derived from sound data and decision making processes. Independent external peer review processes and program reviews enhance acceptability of key Focus Area decisions and data. Cost savings and benefit analyses ensure that potential Draft 2006 Plan mortgage reductions are understood.

Regulatory and Site Acceptance (FY 1999 funding \$5.4 million) contributes to mortgage reduction by helping states establish acceptance verification protocols and reciprocity guidelines to expedite multi-state permitting and multi-site deployment. Site acceptance is facilitated by linking site needs to innovative technologies as early as possible.

International Technology Coordination (FY 1999 funding \$1.5 million) expands the number of Focus Area cost-saving innovative technologies available for EM use. Accelerates the EM cleanup by leveraging international science and technology opportunities.

Safety and Health Testing (FY 1999 funding \$3.5 million) reduces costs of cleanup and improves worker safety and health by providing operational assessments of high impact environmental technologies and recommending safety, efficiency, and productivity enhancements.

SCIENCE PROGRAM

<u>FY 1997</u>	<u>FY 1998</u>	<u>FY 1999</u>
\$48,675	\$46,110*	\$31,158*

The EM Science Program was created to stimulate basic research and technology development for cleanup of the Nation's nuclear weapons complex. The program's objective is to improve the effectiveness of the cleanup effort over the long term. The importance of basic scientific research to the cleanup mission was established in the Secretary of Energy Advisory Board (Galvin) Report: "There is a particular need for long term, basic research in disciplines related to environmental cleanup...Adopting a science-based approach that includes supporting development of technologies and expertise...could lead to both reduced cleanup costs and smaller environmental impacts at existing sites and to the development of a scientific foundation for advances in environmental technologies."

* Excludes SBIR assessment related to the Science Program in the amount of \$1,212,000 in FY 1998 and \$842,000 in FY 1999.

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

FY 1999 CONGRESSIONAL BUDGET THEMES

Science Program - (cont'd)

The Science Program represents a partnership between the Office of Energy Research and the EM program. The Office of Energy Research manages the solicitation of proposals and scientific review process. The Office of Environmental Management ensures that the research is relevant to the Department's cleanup problems and that results of the research are communicated to the DOE and contractor personnel addressing cleanup problems. Projects funded to date focus on critical problems identified through: workshops at Richland, Savannah River, Oak Ridge and Idaho; a complex wide needs survey; solicitation of science research needs in support of the Draft 2006 Plan; and systems engineering analysis. To date, of the 204 projects selected, 87 focus on science needed to improve remedial action process; 46 focus on finding better ways to treat and destroy high level waste; 29 focus on waste containing a mixture of radioactive and other hazardous materials (mixed waste); 18 focus on better understanding the health and ecological effects associated with environmental cleanup options; 10 address the materials used in weapons production (nuclear materials) and the remaining 14 projects focus on technical problems with facility deactivation and decommissioning and spent nuclear fuel stabilization and disposal. This competitive program has been effective in establishing a link between the EM program and the scientific community. Eleven of DOE's national laboratories, 64 academic institutions, and a number of other Federal laboratories and industrial organizations currently participate in the program. FY 1999 is the last year of funding for the first 138 grants awarded by the program, a \$112,000,000 investment. Early results from this research should begin to have a significant impact on the EM program in FY 1998.

	<u>FY 1997</u>	<u>FY 1998</u>	<u>FY 1999</u>
<u>RISK PROGRAM</u>	\$12,124	\$ 7,000	\$ 5,000

Risk informed decision making is critical to the success of the EM program. The Risk Policy program provides the analytical framework and technical support necessary for credible, risk-based environmental decisions. The program provides guidance and tools to assist the project managers in collection of the information that will ensure that high risk projects are prioritized and funded and that risk to workers, the public, and the environment decrease over time. This program supports the risk research needed to support aggressive environmental cleanup of the nuclear weapons production legacy while ensuring that the safety and health of the DOE workforce and members of the public, and the protection of the environment are not compromised in the process.

SCIENCE AND TECHNOLOGY DEVELOPMENT

TECHNOLOGY DEVELOPMENT AND DEPLOYMENT

MIXED WASTE, CHARACTERIZATION, TREATMENT AND DISPOSAL FOCUS AREA

I. Mission Supporting Goals and Objectives

The Mixed Waste Characterization, Treatment and Disposal Focus Area (MWFA) provides solutions for supporting effective, efficient mixed waste treatment technology systems. Site Treatment Plans have identified 175,000 cubic meters of mixed waste in storage that includes over 1,400 mixed waste streams at 40 sites. In addition, 181,000 cubic meters of mixed low-level and transuranic waste is estimated to be generated over the next 5 years. The MWFA-developed technologies are addressing the mixed-low-level waste needs identified in the Draft 2006 Plan. Cost savings of \$2 to \$3 billion over conventional cleanup approaches could be achieved through use of these innovative technologies. Having developed and assessed several primary mixed waste treatment systems, the current MWFA strategy emphasizes four thrusts: demonstration of non-thermal treatment systems; handling and non-destructive evaluation of mixed and TRU waste; managing thermal treatment system effluents; and development of TRU waste treatment in support of WIPP. These activities support DOE efforts to meet its schedule commitments to regulators and the public at 40 sites in 19 states. Within the funding provided, this Focus Area will assist in the deployment of alternative technologies at individual sites to reduce risk and cost, and to accelerate cleanup at those sites.

II. Funding Schedule

<u>Program Activity</u>	<u>FY 1997</u>	<u>FY 1998</u>	<u>FY 1999</u>	<u>\$ Change</u>	<u>% Change</u>
Mixed Waste, Characterization, Treatment and Disposal Focus Area	<u>\$66,014</u>	<u>\$37,879</u>	<u>\$20,835</u>	<u>\$- 17,044</u>	<u>-45%</u>
Total, Mixed Waste, Characterization, Treatment and Disposal Focus Area	<u>\$66,014</u>	<u>\$37,879</u>	<u>\$20,835</u>	<u>\$- 17,044</u>	<u>-45%</u>

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

III. Performance Summary - Accomplishments:

	<u>FY 1997</u>	<u>FY 1998</u>	<u>FY 1999</u>
<u>Mixed Waste, Characterization, Treatment and Disposal Focus Area</u> - (cont'd)			

Non-Thermal Treatment Systems

Activities include developing and assessing technologies in salt and ash stabilization; amalgamation, stabilization, separation and removal of mercury from liquid and solid waste; and alternative mixed waste oxidation techniques. Regulatory and public concern have resulted in specific instances in which alternatives to high temperature treatment (i.e., incineration) must be used for mixed waste prior to disposal. Stakeholders are highly supportive of alternatives to open flame treatment systems because of reduced off-gas emissions. Use of these technologies is complicated by large quantities of secondary (and possibly toxic or corrosive) waste generation. The resolution of these issues requires further testing. Although the number of potential waste streams amenable to this type of treatment is limited, these technologies in certain instances provide preferable treatment alternatives. Demonstrations will provide performance data on guidelines for selection of the most appropriate technology for treatment of a given waste.

\$27,265	\$15,684	\$6,000
----------	----------	---------

- In FY 1997:
 - The commercialization of polymer macroencapsulation was completed. This stabilization technology enabled DOE to eliminate 520,000 pounds of contaminated lead and debris at 23 sites from its mixed waste inventory. Testing of three ash and salt stabilization techniques were demonstrated that will provide greater flexibility in treating problem wastes compared to the standard, cement grout technology. Comparison of several different common final waste forms to the DOE disposal requirement was initiated, and started testing, evaluation and demonstration of several alternative waste oxidation technologies.

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

III. Performance Summary - Accomplishments:

FY 1997

FY 1998

FY 1999

Mixed Waste, Characterization, Treatment and Disposal Focus Area - (cont'd)

Non-Thermal Treatment Systems (cont'd)

- In FY 1998:
 - Complete demonstrations addressing mercury stabilization, separation, or removal from waste streams; at Oak Ridge, complete evaluation and technical performance report for three salt and ash waste stabilization technologies; and continue demonstration, testing, and technical performance reports for alternative waste oxidation processes, such as Acid Digestion and Direct Chemical Oxidation.
- In FY 1999:
 - Complete development and demonstration of technologies to address alternatives to open flame combustion high temperature treatment (i.e., incineration). These technologies support facility compliance at six sites addressing approximately 5,400 cubic meters of mixed low-level and mixed transuranic waste.
 - Complete demonstration of Direct Chemical Oxidation at Lawrence Berkeley Laboratory on destruction of contaminated organic waste.
 - Initiate demonstration of sludge washing at Oak Ridge on contaminated soil.
 - Complete demonstration of Acid Digestion for mixed and TRU waste at Albuquerque and Savannah River.
 - Complete demonstration of advanced sorbents for RCRA metals at Savannah River.

Handling and Non-Destructive Evaluation of Mixed and TRU Waste

Activities address characterization of containerized mixed transuranic (TRU) and other radioactive waste; waste material handling; including sorting and segregating requirements to meet the Waste Isolation Pilot Plant (WIPP) acceptance criteria and transportation regulations. Opening of the waste drum is expensive and exposes workers to the waste material.

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

III. Performance Summary - Accomplishments:

	<u>FY 1997</u>	<u>FY 1998</u>	<u>FY 1999</u>
<u>Mixed Waste, Characterization, Treatment and Disposal Focus Area</u> - (cont'd)			
Handling and Non-Destructive Evaluation of Mixed and TRU Waste - (cont'd)			
Non-destructive evaluation/assay (NDE/NDA) technologies have been proposed by the Carlsbad Area Office and the operation sites to resolve this issue. However, due to the complexity of the stored waste, much work is necessary to achieve complete operation status of the NDE/NDA technology to meet TRU needs across the DOE complex.	\$9,266	\$4,430	\$5,235
<ul style="list-style-type: none"> • In FY 1997: <ul style="list-style-type: none"> - Tested and demonstrated instrumentation capable of non-intrusively characterizing mixed low-level, and mixed transuranic waste containers (i.e. drums) for radionuclides. These technologies will allow sites to certify waste for shipment to WIPP. In addition, developed an alternative method for venting hydrogen gas as it is generated in TRUPACT™ containers. This will allow the maximum amount of transuranic waste per TRUPACT™ container, thereby safely reducing the number of shipping containers required and subsequently the costs. • In FY 1998: <ul style="list-style-type: none"> - Develop and test NDE/NDA characterization technologies and instrumentation; complete the development, demonstration, and assessments of technologies/methods to reduce hydrogen gas generation; complete contact handled radioactive demonstration, initiate development of technologies for contact and remote handled RCRA wastes; and continue development and testing of material handling systems associated with treating mixed low-level and mixed TRU waste. 			

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

III. Performance Summary - Accomplishments:

FY 1997 FY 1998 FY 1999

Mixed Waste, Characterization, Treatment and Disposal Focus Area - (cont'd)

Handling and Non-Destructive Evaluation of Mixed and TRU Waste - (cont'd)

- In FY 1999:
 - Complete the development and testing of NDE/NDA characterization technologies and instrumentation for assaying waste drums at Idaho, Oak Ridge, and Rocky Flats.
 - Demonstrate instrumentation to determine nature of waste matrix in drums and boxes to allow waste shipments to WIPP.
 - Initiate development of instruments to remotely measure high activity transuranic waste, californium, and curium material.
 - Demonstrate automated systems that sort and segregate material (e.g., debris from sludge) before waste treatment at Idaho, Richland and Savannah River.

Thermal Treatment Systems

In order to allow land disposal of treated mixed waste (i.e., meet Environmental Protection Agency's (EPA) RCRA Land Disposal Restrictions and DOE Orders), the MWFA funded the development of joule-heated and high temperature melter systems. These systems produce a leach-resistant superior final waste form which meets disposal requirements. These are now either in use or planned for use in four large DOE privatization contracts which include the Advanced Mixed Waste Treatment Facility at the Idaho National Engineering and Environmental Laboratory (INEEL). Although, these vitrification technologies are well developed, there is still uncertainty associated with products of incomplete combustion generation for off-gas treatment. Off gas treatment systems must be proven to be effective to make these technologies more widely applicable.

\$29,483 \$17,765 \$4,600

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

III. Performance Summary - Accomplishments:

FY 1997

FY 1998

FY 1999

Mixed Waste, Characterization, Treatment and Disposal Focus Area - (cont'd)

Thermal Treatment Systems (cont'd)

- In FY 1997:
 - The Transportable Vitrification System (TVS) began shake down testing at Oak Ridge using actual radioactive waste. Partitioning behavior of TRU (plutonium oxides) waste constituents between the glass/slag, metal and gas phases under typical vitrification conditions was investigated. Testing of continuous emissions monitoring of volatile metals, particulates, volatile organic compounds (VOC) and TRU radionuclides emerging from thermal treatment off-gas systems was initiated. Work was conducted to remove mercury in a waste pre-treatment step (see the Non-thermal Work Description) and monitor its presence in off-gas emissions from thermal treatment systems. An evaluation of multi-metal continuous emission monitors (CEMs), in cooperation with the EPA, and several enabling off-gas components were completed. These activities were conducted to make thermal treatment systems more acceptable to regulators and stakeholders.
- In FY 1998:
 - The TVS demonstration will be completed after two to four months of hot testing at Oak Ridge and a technology performance report generated. After completion of hot tests, the Office of Waste Management will use TVS to complete treatment of wastes from ponds B and C, and other sludges. Work will continue in the area of CEM development throughout FY 1998 and the evaluation of several enabling off-gas components will be completed. This work will include the assessment of CEM performance in controlled conditions, and compliment tests at the Western Environmental Technology Office (WETO).

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

III. Performance Summary - Accomplishments:

FY 1997 FY 1998 FY 1999

Mixed Waste, Characterization, Treatment and Disposal Focus Area - (cont'd)

Thermal Treatment Systems (cont'd)

- In FY 1999:
 - Develop and test technologies to destroy products of incomplete combustion (e.g. dioxins) for thermal treatment systems at Idaho and Savannah River.
 - Demonstrate Multi-Metal CEM for use at Oak Ridge.
 - Demonstrate a self calibrating CEM for toxic metals for use at Toxic Substance Control Act (TSCA) Incinerator at Oak Ridge.
 - Demonstrate real-time plutonium monitors for plutonium immobilization project at Savannah River.

Transuranic Waste Technologies

All major sites and laboratories that will ship transuranic wastes to WIPP have identified technology needs in preparing their waste for shipment and disposal. While current technologies focus primarily on enabling the successful management of low-activity, contact handled transuranic wastes in 55 gallon drums, a large portion of the waste consists of categories for which handling and thus transportation is not currently available. These include transuranic waste sludges; Plutonium-Uranium Extraction (PUREX) type wastes; contaminated equipment, debris and facilities; transuranic wastes containing problem organics; transuranic wastes containing Pu-238 and Am-241; transuranic waste residues; and newly generated transuranic wastes. Activities will focus on ways to improve transuranic waste handling and pre-packaging, increase canister volume loading, and waste reduction prior to shipment. All activities relating to identification, development and assessment of technologies will be closely coordinated with the National Transuranic Waste Management Program at the DOE Carlsbad Area Office.

\$ 0 \$ 0 \$5,000

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

III. Performance Summary - Accomplishments:

	<u>FY 1997</u>	<u>FY 1998</u>	<u>FY 1999</u>
<u>Mixed Waste, Characterization, Treatment and Disposal Focus Area</u> - (cont'd)			
Transuranic Waste Technologies (cont'd)			
<ul style="list-style-type: none"> • In FY 1999: <ul style="list-style-type: none"> - Develop projects that focus on characterization of problematic transuranic waste streams within the DOE complex. - Demonstrate technologies that will eliminate or reduce the need to repackage TRU waste from Idaho and Rocky Flats for shipment to WIPP. - Develop technologies that increase the curie, size, and weight limits for shipment of TRUPACT™ containers to WIPP from Idaho, Rocky Flats, and Savannah River. - Demonstrate technologies that reduce treatment requirements prior to transport to WIPP. 			
Total, Mixed Waste Characterization Treatment and Disposal Focus Area	<u>\$66,014</u>	<u>\$37,879</u>	<u>\$20,835</u>
<u>Explanation of Funding Changes from FY 1998 to FY 1999:</u>			
Non-Thermal Treatment: Complete in FY 1998 demonstrations and evaluations of technologies for the stabilization, separation, and removal of salt, ash, and mercury.			-\$9,684
Handling and Non-Destructive Evaluation: Initiate development of instruments to remotely measure high activity transuranic waste, californium and curium matter.			+\$805
Thermal Treatment: Completion of melter technologies and a shift in focus away from thermal systems.			-\$13,165
Transuranic Waste: Initiation of transuranic waste technology development activities.			<u>+\$5,000</u>
Total Funding Change, Mixed Waste, Characterization, Treatment and Disposal			<u>-\$17,044</u>

SCIENCE AND TECHNOLOGY DEVELOPMENT

TECHNOLOGY DEVELOPMENT AND DEPLOYMENT

RADIOACTIVE TANK WASTE REMEDIATION FOCUS AREA

I. Mission, Supporting Goals, and Objectives

There are 336 radioactive waste storage tanks across the DOE complex containing over 100 million gallons of radioactive waste. Most of these tanks have exceeded their design life and represent significant occupational and public risks. Current site baseline technologies are costly, pose significant programmatic and safety risks, and have technology gaps. The mission of the TFA is to systematically manage the development and facilitate deployment of technologies using an integrated approach to safely and efficiently achieve tank waste remediation across the DOE complex in support of the Draft 2006 Plan. Execution of this mission will support complex wide tank farm closure while minimizing life-cycle costs. This Focus Area is addressing the technical needs identified for high-level waste in the Draft 2006 Plan. Site technology needs are being addressed through efforts in three areas: the Hanford Tanks Initiative; tank waste retrieval and closure; and tank waste pretreatment and immobilization. TFA activities have progressed from early-stage technology development to advanced, fully deployable systems. This work is being accomplished in close partnership with users and with continual participation of tribal governments, regulators, and stakeholders. Within the funding provided, this Focus Area will assist in the deployment of alternative technologies at individual sites to reduce risk and cost, and accelerate cleanup at those sites.

II. Funding Schedule

<u>Program Activity</u>	<u>FY 1997</u>	<u>FY 1998</u>	<u>FY 1999</u>	<u>\$ Change</u>	<u>% Change</u>
Radioactive Tank Waste Remediation Focus Area .	<u>\$54,905</u>	<u>\$53,982</u>	<u>\$45,885</u>	<u>\$-8,097</u>	<u>-15%</u>
Total, Radioactive Tank Waste Remediation Focus Area	<u>\$54,905</u>	<u>\$53,982</u>	<u>\$45,885</u>	<u>\$-8,097</u>	<u>-15%</u>

Hanford Tanks Initiative (HTI)

The HTI is a five-year project initiated in FY 1997, that is conducted as a technical and financial partnership between the EM Office of Waste Management and the EM Office of Science and Technology.

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

III. Performance Summary - Accomplishments

	<u>FY 1997</u>	<u>FY 1998</u>	<u>FY 1999</u>
<u>Radioactive Tank Waste Remediation Focus Area</u> - (cont'd)			
Hanford Tanks Initiative (HTI)			
<p>The HTI is a five-year project initiated in FY 1997, that is conducted as a technical and financial partnership between the EM Office of Waste Management and the EM Office of Science and Technology. Project activities focus on two high-level waste tanks at the Hanford site as full-scale test beds to demonstrate waste retrieval and closure technologies necessary to meet goals of the TWRS Privatization Phase II effort at Hanford. Technologies and services will be acquired through performance-based contracts with private industry and national laboratories. These activities will determine the costs of retrieving tank waste; define schedule and risks; establish an acceptable approach to define an end-state for tank closure; demonstrate residual waste characterization; and obtain acceptance by regulatory agencies and stakeholders.</p>	\$7,000	\$10,000	\$10,000
<ul style="list-style-type: none"> • In FY 1997: <ul style="list-style-type: none"> - Assessed commercially available technologies, and past DOE practices for corrosion prevention of tanks to establish baseline alternatives. Assessed the feasibility of obtaining samples from locations other than directly below riser openings to gain better information of tank waste characteristics. Evaluated issues surrounding insertion of characterization equipment into Hanford tanks C-106 and AX-104, and selected systems for demonstration. The DOE's leak mitigation and repair activities were assessed to establish a baseline for testing new equipment during C-106 waste retrieval. Cold demonstrations of four retrieval systems were completed by industry vendors. • In FY 1998: <ul style="list-style-type: none"> - Deploy the Light Duty Utility Arm (LDUA) and complete the sampling campaign to characterize Hanford AX-104 and C-106 single-shell tank (SST) wastes to meet Tri-Party Agreement milestones and TWRS Privatization Phase II schedules. 			

III. Performance Summary - Accomplishments

FY 1997

FY 1998

FY 1999

Radioactive Tank Waste Remediation Focus Area - (cont'd)

Hanford Tanks Initiative (cont'd)

- FY 1998: (cont'd)
 - Provide the cone penetrometer with advanced sensors to characterize the soil surrounding Hanford tank AX-104. Use the LDUA, with gripper end-effector, to enable existing characterization and retrieval devices to be moved to locations within Hanford tank AX-104, other than directly below riser openings.
- In FY 1999:
 - Demonstrate a corrosion probe to evaluate the integrity of Hanford SSTs during retrieval.
 - Industry will demonstrate a full-scale system to mobilize, and retrieve Hanford SST wastes. This will provide a basis for retrieval costs for TWRS Privatization Phase II.
 - Finalize design requirements for closure of tank AX-104 and C-106. These design requirements will be the basis for closing the remaining 147 SSTs.

Tank Waste Retrieval, and Closure

To meet processing, cleaning, and closure requirements, radioactive waste must be removed from the tanks. Removal requires that mixtures of salt cake, sludge, and debris be mobilized and retrieved for further processing. The retrieval processes must be monitored to ensure waste meets process feed specifications, and must be efficient to avoid adding excess water to the system which adds to processing cost and is a leakage concern in tanks of questionable integrity. To meet tank cleaning and closure goals, the sites require technologies to obtain needed data to negotiate closure criteria with their local regulators.

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

III. Performance Summary - Accomplishments

	<u>FY 1997</u>	<u>FY 1998</u>	<u>FY 1999</u>
<u>Radioactive Tank Waste Remediation Focus Area</u> - (cont'd)			
Tank Waste Retrieval, and Closure - (cont'd)			
Cleaning methods and stabilization technologies are also required to encapsulate or immobilize residual waste as well as provide structural integrity and isolation of tanks.	\$16,870	\$25,774	\$19,745
<ul style="list-style-type: none"> • In FY 1997: <ul style="list-style-type: none"> - Provided an integrated characterization and retrieval system to enable Oak Ridge to perform the treatability study for closure of the gunite tanks. Transferred the first LDUA to Hanford TWRS for SST characterization and retrieval operations. Developed grout formulations and new grout injection methods used to support closure of Savannah River Site (SRS) high-level waste tanks 17 and 20. Provided pulse jet mixer pump data to Oak Ridge allowing the Bethel Valley Evaporator Service Tank waste to be mobilized and prepared for transfer to Melton Valley Storage Tanks. Installed hot cell analytical equipment. Developed in tank characterization tools. • In FY 1998: <ul style="list-style-type: none"> - Transfer spray cleaning systems to SRS to retrieve salt cake from Type IV tanks and annuli to meet tank closure goals. Provide borehole miner performance data to Oak Ridge to enable mobilization and retrieval of waste from the Old Hydro Fracture tanks for consolidation into the Melton Valley Storage Tanks prior to treatment by a private vendor. Establish grout specifications and emplacement requirements to enable tank closure at Oak Ridge. Deploy the LDUA at Idaho to retrieve HLW samples of tank heels and establish a process and basis for retrieval and closure decisions. Complete installation and final testing of hot cell analytical equipment. Complete demonstration and deployment of in tank characterization tools. 			

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

III. Performance Summary - Accomplishments

FY 1997 FY 1998 FY 1999

Radioactive Tank Waste Remediation Focus Area - (cont'd)

Tank Waste Retrieval, and Closure (cont'd)

- In FY 1999:
 - Facilitate deployment of an in-tank density gradient technique to retrieve salt cake from SRS type I/II Tanks.
 - Provide technologies for hard sludge heel retrieval from SRS Type I/II Tanks.
 - Transfer the Pulsair mixer to Oak Ridge to mobilize waste for transfer.
 - Immobilize Oak Ridge tank residual waste using in-tank grout injections.
 - Demonstrate the tank plugging system at Oak Ridge to isolate tanks from the environment.
 - Transfer in line solids monitoring systems to Oak Ridge to minimize plugging conditions.

Tank Waste Pretreatment and Immobilization

Pretreatment technologies are needed to condition supernate, sludge, and salt cake to meet feed stream specifications for waste immobilization, including solid liquid separation, radiochemical extraction, and excess water removal. Existing immobilization processes also must be enhanced to handle a broader envelope of waste streams and increase production. Through enhancements of current pretreatment and immobilization technologies, significant reductions in costs can be achieved per volume of waste processed.

\$31,035 \$18,208 \$16,140

- In FY 1997:
 - Completed demonstration of a compact process unit for removal of radionuclides from Oak Ridge waste. Completed radioactive sludge filtration testing on Hanford waste to support development of the pretreatment flowsheet.

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

III. Performance Summary - Accomplishments

FY 1997

FY 1998

FY 1999

Radioactive Tank Waste Remediation Focus Area - (cont'd)

Tank Waste Pretreatment and Immobilization - (cont'd)

- In FY 1997: (cont'd)
 - Provided data for potential enhancements to Defense Waste Processing Facility (DWPF) to increase waste loading, and rate of future canister production. Completed development of process equipment specifications for thermal denitration, and testing of a filtration system for strontium extraction of Idaho waste. Completed waste form specifications for immobilization of Oak Ridge low-level waste.
- In FY 1998:
 - Prepare and test a salt-cake dissolution model to ensure that the feed streams provided to Hanford Phase I vendors meet specifications. Issue reports on chromium leaching, leachate chemistry, and enhanced sludge washing to identify sludge processing limitations and possible enhancements and ensure that TWRS Privatization Phase II is successful. Complete reports summarizing cesium removal test results and recommending a thermal denitration process for Idaho acidic wastes. Complete solid-liquid separations tests of Idaho dissolved calcine to enable immobilization. Complete a technical report documenting potential Hanford immobilization enhancements to increase waste loading and canister production.
- In FY 1999:
 - Deliver a solid-liquid separation system to Oak Ridge, to pretreat tank wastes.
 - Demonstrate an integrated pretreatment process for treatment of Idaho tank and calcine waste to meet Batt Compliance Agreement.
 - Demonstrate an out-of-tank evaporator compact processing unit for DWPF recycle streams.

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

III. Performance Summary - Accomplishments

	<u>FY 1997</u>	<u>FY 1998</u>	<u>FY 1999</u>
<u>Radioactive Tank Waste Remediation Focus Area</u> - (cont'd)			
Tank Waste Pretreatment and Immobilization - (cont'd)			
<ul style="list-style-type: none"> In FY 1999: (cont'd) <ul style="list-style-type: none"> - Develop standard testing methods for waste acceptance as a basis for payment of TWRS Privatization Phase II vendors. - Demonstrate an improved pouring spout, and level and density monitors for the third DWPF melter. 			
Total, Radioactive Tank Waste Remediation Focus Area	<u>\$54,905</u>	<u>\$53,982</u>	<u>\$45,885</u>
<u>Explanation of Funding Changes from FY 1998 to FY 1999:</u>			
Retrieval and Closure: Demonstrate technologies for hard sludge heel retrieval and demonstrate integrated pretreatment processes at several sites; complete, in FY 1998, installation and testing of hot cell equipment and demonstration and deployment of in-tank characterization tools.			-\$6,029
Pretreatment and Immobilization: Complete salt-cake dissolution test; solid-liquid separations tests; and technical reports.			-\$2,068
Total Funding Change, Radioactive Tank Waste Remediation			<u>-\$8,097</u>

SCIENCE AND TECHNOLOGY DEVELOPMENT

TECHNOLOGY DEVELOPMENT AND DEPLOYMENT

SUBSURFACE CONTAMINANTS FOCUS AREA

I. Mission, Supporting Goals, and Objectives

Across the DOE complex, there are currently 3 million cubic meters of buried waste which is not adequately contained. In addition, 5,700 plumes contaminate more than 200 million cubic meters of soil and 600 billion gallons of ground water with volatile organic compounds (VOCs), Dense Non-Aqueous Phase Liquids (DNAPLs), hazardous metals, and radionuclides. In order to meet the Draft 2006 Plan goals and compliance requirements, cleanup must be accelerated and cleanup costs must be reduced while maintaining worker and public safety. The mission of the Subsurface Contaminants Focus Area (SCFA) is to develop, demonstrate and facilitate deployment of innovative technologies that will result in a more cost effective and expeditious cleanup of DOE's contaminated sites. Technologies being addressed by this Focus Area are identified as ground water and soil needs in the Draft 2006 Plan. Initial estimates from the field sites for the Draft 2006 Plan indicate a potential cost saving for ground water and soils cleanup of \$3.2-\$3.7 billion, based on the use of innovative technologies. Within the funding provided, this Focus Area will assist in the deployment of alternative technologies at individual sites to reduce risk and cost, and the cleanup at those sites.

II. Funding Schedule

<u>Program Activity</u>	<u>FY 1997</u>	<u>FY 1998</u>	<u>FY 1999</u>	<u>\$ Change</u>	<u>% Change</u>
Subsurface Contaminants Focus Area	<u>\$57,556</u>	<u>\$32,970</u>	<u>\$31,700</u>	<u>\$- 1,270</u>	<u>-4%</u>
Total, Subsurface Contaminants Focus Area	<u>\$57,556</u>	<u>\$32,970</u>	<u>\$31,700</u>	<u>\$-1,270</u>	<u>-4%</u>

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

III. Performance Summary - Accomplishments

Subsurface Contaminants Focus Area - (cont'd)

FY 1997

FY 1998

FY 1999

DNAPLs (Delineation, Removal or In Situ Treatment)

All major DOE sites have ground water contamination resulting from the discharge of difficult to remediate toxic and carcinogenic solvents termed, Dense Non-Aqueous Phase Liquids (DNAPLs) into the soil. DNAPLs are difficult to locate, and even in small quantities, create large ground water plumes. The dense nature and very low solubility of these compounds allows them to move downward through the unsaturated zone and ground water and to spread laterally along low permeability layers forming disseminated pools, which slowly contaminate ground water. Presently sites do not have the capability to locate DNAPL sources: therefore, pump-and-treat, or other costly and ineffective treatment systems must be used to maintain minimal compliance and to carry out a minimal and time consuming cleanup. The SCFA continues to focus on developing technologies and methods to locate and quantify DNAPL plumes, treat the contaminated ground water and soils in situ to reduce mortgages while enabling cost effective cleanup. Many SCFA activities including in situ destruction, seismic characterization, surfactant flushing and natural attenuation are leveraged and shared with the EM Office of Environmental Restoration (ER), industry partners and other government agencies. The work being done by the DOE laboratories is larger in scale and more applied than that performed by other Federal agencies, and will provide DOE and its partners with full-scale validated, cost effective technology solutions for current and planned remediation activities:

\$11,550

\$10,200

\$13,600

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

III. Performance Summary - Accomplishments

FY 1997

FY 1998

FY 1999

Subsurface Contaminants Focus Area - (cont'd)

DNAPLs (Delineation, Removal or In Situ Treatment) (cont'd)

- In FY 1997:
 - Developed, with industry partners, remediation technologies for improved chlorinated solvent remediation, such as Electro-Osmosis (LASAGNA™) and In Well Vapor Stripping (NoVocs™), which reduce remediation time and overall cost. Continued to develop and demonstrate technologies to locate DNAPL sources, and to evaluate mobility using tracers, geophysical and physical/chemical techniques to minimize the number of samples and bore holes. Conducted field scale development of in situ treatment technologies to destroy DNAPLs through chemical oxidation, and hydrous pyrolysis.
- In FY 1998:
 - Continue demonstrating techniques to locate and delineate DNAPL sources with initial validation at a site (Cape Canaveral) selected by a joint Federal and private sector consortium. Conduct full-scale in situ field experiments utilizing chemical oxidation and hydrous pyrolysis for DNAPL destruction.
- In FY 1999:
 - Continue the validation of characterization technologies to locate and quantify DNAPLs at Oak Ridge National Laboratory.
 - Deliver to ER performance specifications for DNAPL in situ remediation techniques.
 - Demonstrate and deliver to ER, deep emplacement methods for in situ treatment technologies.

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

III. Performance Summary - Accomplishments

FY 1997

FY 1998

FY 1999

Subsurface Contaminants Focus Area - (cont'd)

DNAPLs (Delineation, Removal or In Situ Treatment) (cont'd)

- FY 1999: (cont'd)
 - Demonstrate with ER monitoring and verification technologies for deep in situ treatment.
 - Demonstrate accelerated bioremediation with the United States Air Force (USAF), Department of Defense, EPA, and private industry.

Landfill Treatment and Containment

DOE continues to spend large resources on the monitoring and maintenance of leaking radioactive and mixed waste landfills to achieve compliance and will not be able to remediate these landfills to appropriate standards due to the presence of dangerous and inappropriately disposed materials. Landfill containment technologies have been deployed across the country. However, many caps and covers continue to fail. Verification and monitoring of barrier systems exists only for engineered landfills (prior to waste emplacement), and emplacement of barriers at significant depths has not been accomplished. In addition, source term retrieval of DOE mixed waste has not been done. Therefore, better caps, covers, and barriers need to be developed to prevent the migration of the unique wastes disposed of at DOE sites. Technologies also need to be developed to stabilize and/or retrieve source terms with unusually high contamination levels so that these can be appropriately treated or disposed. These technologies will reduce the risk of migration of contaminants in the environment and facilitate safer cleanup where cleanup is appropriate. All this serves to reduce risk to the public and site workers as well as reducing environmental degradation.

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

III. Performance Summary - Accomplishments

Subsurface Contaminants Focus Area - (cont'd)

FY 1997 FY 1998 FY 1999

Landfill Treatment and Containment (cont'd)

Some activities scheduled for FY 1999 represent the completion of multi-year tasks and have been carried out in cooperation with the EPA and other federal agencies.

All activities support the Draft 2006 Plan for landfills, pits and trenches - to contain, treat in place and, when necessary, retrieve source terms (hot spots).

\$18,600 \$11,600 \$ 8,000

• In FY 1997:

- Continued the installation and verification monitoring of alternative containment and landfill cover systems that provide more cost-effective and longer-life than conventional methods. Conducted pilot- and full-scale demonstrations of barriers to contain contaminants or direct their flow toward treatment zones and demonstrated methods to monitor the long-term performance of containment systems. Conducted full-scale field tests of a system for high pressure jet injection of a thin containment barrier. The test included verification and monitoring tools to evaluate the integrity and long-term performance of the barrier. This work was performed in conjunction with the EPA, USAF and the private sector with the support of WETO. Initiated demonstration of in situ remediation methods for containment and/or retrieval and treatment of highly contaminated areas ("hot spots"). Completed installation and initiated monitoring of a frozen soil barrier at the Oak Ridge National Laboratory (ORNL).

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

III. Performance Summary - Accomplishments

FY 1997

FY 1998

FY 1999

Subsurface Contaminants Focus Area - (cont'd)

Landfill Treatment and Containment (cont'd)

In FY 1998:

- Complete full scale performance verification of alternative landfill covers and subsurface barriers. Initiate studies for demonstrations of long-term containment systems, including verification and monitoring to meet compliance. Complete an evaluation of chemically resistant grout materials for construction of thin barrier walls. Pending successful demonstration, thin barrier walls will be implemented at a Dover Air Force Base site by the USAF to support the remediation of DNAPLs. Continue demonstration and implementation activities for hot spot remediation of contaminated subsurface waste and soils at a selected DOE site. Complete performance verification and monitoring of the frozen soils barrier. Provide the data to the Oak Ridge EM Office of Waste Management for potential wide-scale deployment.

• In FY 1999:

- Deliver to EPA data for re-write of national landfill cover design guidance.
- Deliver alternative landfill covers to Albuquerque, Idaho, and Richland.
- Deliver long-term cap design criteria to ER.
- Demonstrate deep barrier emplacement with ER.
- Demonstrate barrier materials that resist radionuclide exposure degradation.
- Implement with ER, "hot spot" stabilization and retrieval technologies at Idaho.

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

III. Performance Summary - Accomplishments

Subsurface Contaminants Focus Area - (cont'd)

FY 1997 FY 1998 FY 1999

Radionuclides and Other Materials in the Soils

Metals and radionuclides contamination unique to DOE prevail in about half of DOE's contaminated sites. Current technologies for the treatment of metals and radionuclides, excavation followed by ex situ treatment or pump-and-treat, are costly, ineffective, and involve risk to workers. In addition, they are inadequate for attainment of the Draft 2006 Plan goals. To address the existing site needs, technologies need to be developed that eliminate/reduce volume of secondary waste and reduce workers' exposure. Partnerships with EPA, DOD, and others will continue to more fully address the DOE technology needs for metals and radionuclide remediation. Failure to continue these activities will leave DOE without cost effective technology solutions for current and planned remediation activities.

\$12,100 \$11,170 \$10,100

- In FY 1997:
 - Developed and provided to ER performance specifications for remediation technologies including electrokinetics, solution mining and soil leaching which enhanced mobilization, extraction and removal of metals and radionuclides and ensure waste volume reduction. Performance specifications were developed and provided to ER. Developed and implemented in situ reaction zone barrier and permeable treatment barriers for metals and radionuclides, to passively capture contaminants and prevent off-site plume migration. Installed and evaluated full-scale reactive barriers for Bear Creek Valley at Y-12 site, Oak Ridge, Rocky Flats, and Mound.

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

III. Performance Summary - Accomplishments

FY 1997

FY 1998

FY 1999

Subsurface Contaminants Focus Area - (cont'd)

Radionuclides and Other Materials in the Soils (cont'd)

- In FY 1997: (cont'd)
Developed in situ chemical treatment technologies to chemically alter, immobilize and detoxify metals and radionuclides which included completion of pilot-and full-scale demonstration of MAG*SEP™, Electro-Osmosis, and bioremediation of toxic metals technologies.
- In FY 1998:
 - Demonstrate and implement reactive barrier optimizations for reactive material replacement or recharge; evaluate additional system designs to overcome plugging; coordinate with other federal agencies and private industry to leverage gains in other reactive barrier development for metal and radionuclide contaminants. In conjunction with ER, implement in situ chemical treatment technologies such as In Situ Redox at Hanford 100 Area. Continue the evaluation of bioremediation technologies, supporting the efforts of the Remediation Technology Development Forum and ER NABIR program.
- In FY 1999:
 - Demonstrate and implement deep reactive barriers with the Office of Environmental Restoration.
 - Demonstrate and implement verification and monitoring for deep reactive barriers.
 - Develop alternative mobilization and extraction materials for removal of metals and radionuclides in soil.
 - Continue development of natural attenuation and bioremediation with the ER NABIR program.

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

III. Performance Summary - Accomplishments

Subsurface Contaminants Focus Area - (cont'd)

FY 1997 FY 1998 FY 1999

VOCs in Ground water and Soil

This effort developed, successfully demonstrated, implemented and deployed in situ remediation systems for volatile organic compound (VOC) that provide alternatives to pump-and-treat. The VOCs have been a large problem for the DOE as well as the private sector. Completed the closeout of development efforts in this area due to the creation and enhancement of appropriate technologies to address the problem. [A distinction has been made between VOCs and the more difficult to remediate organic compound DNAPLs. This was done to communicate the change in focus of the activity and highlight the progress made to date]. These technology solutions provide cost effective remediation alternatives for various environmental conditions and geologic regions. The following are some examples of VOC technologies that were completed in FY 1997 and are now part of the tool box for VOC remediation technologies.

\$15,306 \$ 0 \$ 0

- In FY 1997:
 - Developed soil heating technologies such as Thermally Enhanced Vapor Extraction and Six Phase Soil Heating that are now commercially available and have become the baseline technology for VOC remediation within ER. Bioremediation techniques for VOCs are also commercially available and have become widespread in their use around the country. In addition, the cone penetrometer and many associated sensors have become the state of the practice as part of the system for the remediation of VOCs. Horizontal Drilling and Horizontal Wells as well as In Well Vapor Stripping are now commercially available for the remediation of VOCs.

Total, Subsurface Contaminants Focus Area

\$57,556 **\$32,970** **\$31,700**

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

III. Performance Summary - Accomplishments

Subsurface Contaminants Focus Area - (cont'd)

FY 1997

FY 1998

FY 1999

Explanation of Changes from FY 1998 to FY 1999:

DNAPLs: Demonstrate deep emplacement methods for in situ treatment technologies; monitoring and verification technologies; and accelerated bioremediation technologies. +\$3,400

Landfill Treatment and Containment: Complete in FY 1998, demonstration of the alternative Landfill Cover; evaluation of chemically resistant grout materials for construction of thin barrier walls; and frozen soils barrier performance verification and monitoring. -\$3,600

Radionuclides and Other Materials in the Soils: Leveraging of knowledge gained by EPA, DOD, and the private sector through the development of technologies like deep barrier emplacement, which can be applied to containment, remediation of metals and radionuclides and DNAPLs. -\$1,070

Total Funding Change, Subsurface Contaminants **-\$1,270**

SCIENCE AND TECHNOLOGY DEVELOPMENT

TECHNOLOGY DEVELOPMENT AND DEPLOYMENT

DEACTIVATION AND DECOMMISSIONING FOCUS AREA

I. Mission, Supporting Goals, and Objectives

The mission of the Deactivation and Decommissioning Focus Area (DDFA) is to efficiently and cost effectively develop, demonstrate and facilitate the implementation of safe/low risk systems to solve the EM Office of Environmental Restoration and the EM Office of Nuclear Material and Facility Stabilization identified needs for acceptable deactivation and decommissioning (D&D) of DOE's radiologically contaminated surplus facilities. The DDFA uses a Large-Scale Demonstration Project (LSDP) approach. This approach focuses on specific, high priority D&D projects identified by and co-funded with the user. The LSDPs demonstrate innovative and improved D&D technologies at full scale, side by side with existing commercial technologies. The intent is to compare benefits from using a suite of innovative D&D technologies against those associated with baseline technologies. Primary drivers of this work are the reduction of risk to workers involved in the cleanups, and the recycle (where feasible) or reduction of the large amounts of waste generated from the D&D activities. Effective deployment of D&D technologies to satisfy these needs could lead to cost savings ranging from \$600 million to \$1,400 million as projected in the initial estimates from the field sites for the Draft 2006 Plan. Within the funding provided, this Focus Area will assist in the deployment of alternative technologies at individual sites to reduce risk and cost, and accelerate the cleanup at those sites.

II. Funding Schedule

<u>Program Activity</u>	<u>FY 1997</u>	<u>FY 1998</u>	<u>FY 1999</u>	<u>\$ Change</u>	<u>% Change</u>
Deactivation and Decommissioning Focus Area	<u>\$30,192</u>	<u>\$28,485</u>	<u>\$20,845</u>	<u>\$-7,640</u>	<u>-27%</u>
Total, Deactivation and Decommissioning Focus Area	<u>\$30,192</u>	<u>\$28,485</u>	<u>\$20,845</u>	<u>\$-7,640</u>	<u>-27%</u>

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

III. Performance Summary - Accomplishments - (cont'd)

Deactivation and Decommissioning Focus Area - (cont'd)

FY 1997 **FY 1998** **FY 1999**

Production Reactors D&D

This cost shared (with the EM Office of Environmental Restoration) Large Scale Demonstration Project (LSDP) on the Hanford 105-C Reactor will showcase a series of 20 technologies at full scale to decontaminate the reactor, remove surrounding facilities and configure the remaining block in a safe condition for storage. This suite of technologies will then be applied to 12 additional reactors at Hanford and Savannah River to significantly reduce the cost of reactor core D&D. Pending acceptance by regulators and stakeholders this large scale demonstration of technologies for interim safe storage and ultimate removal at a future date could reduce by up to 50 percent the projected near term costs to fully decommission these reactors over the next several years.

\$10,100 \$5,000 \$0

- In FY 1997
 - Demonstrated 12 technologies for facility characterization, worker safety and equipment dismantlement. One of these, a computerized planning tool, called the Stream Management Database System was subsequently deployed at Savannah River and at Chernobyl. Demonstrated and implemented characterization technologies for the laser ranging system and position sensitive radiation detection monitor. Demonstrated the gamma ray imaging characterization technology and the hand-held hydraulic shear dismantlement technology.
- In FY 1998:
 - Complete work on production reactors with an additional eight technologies demonstrated in the areas of decontamination of reactor fuel storage pools and concrete structures, size reduction and removal technologies, and waste minimization during D&D.

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

III. Performance Summary - Accomplishments - (cont'd)

FY 1997

FY 1998

FY 1999

Deactivation and Decommissioning Focus Area - (cont'd)

Production Reactors D&D (cont'd)

- In FY 1999:
 - No activity.

Highly Enriched Uranium Contaminated Facility D&D

This Cost shared (with Office of Nuclear Material and Facility Stabilization) LSDP will demonstrate at full-scale 8-12 innovative cost-effective technologies for complete deactivation of an HEU-contaminated facility (Building 321-M) at the Savannah River Site. Technologies for remote characterization, in situ decontamination of ductwork, remote dismantlement and packaging of contaminated process equipment and large area decontamination will be demonstrated. These technologies will primarily address issues of worker health and safety in highly radioactive environments and also provide mortgage reduction. Surveillance and maintenance, control and accountability costs at SRS will be reduced, with additional deployment opportunities at DOE sites.

\$0

\$5,000

\$6,000

- In FY 1998:
 - Initiate planning of innovative technology demonstration and coordination among various entities on the integrating contractor team.
 - Demonstrate technologies for remote characterization of building surfaces, process equipment and ductwork.
- In FY 1999:
 - Demonstrate technologies for in situ decontamination, remote dismantlement, waste packaging and surface decontamination.

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

III. Performance Summary - Accomplishments - (cont'd)

Deactivation and Decommissioning Focus Area - (cont'd)

FY 1997

FY 1998

FY 1999

Transuranic Contaminated Materials and Waste Disposition

This cost-shared (with Office of Waste Management) LSDP will demonstrate at full-scale 8-12 innovative cost-effective technologies for characterization, decontamination, waste minimization and volume reduction of TRU waste and TRU-contaminated materials. Successful demonstration of innovative technologies for real-time characterization, separation (of LLW and TRU) and remote packaging technologies will significantly reduce the cost and human safety and health risk associated with such operations at LANL and similar operations complexwide. Reduces WIPP TRU waste disposal costs with additional deployment opportunities at several other sites, especially Rocky Flats.

\$0

\$2,500

\$6,000

- In FY 1998:
 - Provided funding for initial planning of innovative technology demonstrations and coordination among the various entities on the integrating contractor team.
- In FY 1999:
 - Demonstrate technologies for real-time characterization, material segregation, waste minimization and remote packaging.

Tritium-Contaminated Facility D&D

\$0

\$2,500

\$5,845

This cost shared (with Office of Environmental Restoration) LSDP will showcase the demonstration, at full-scale, 8-12 innovative technologies during the early phase of a tritium production facility D&D at Mound. Successful demonstration of remote characterization, decontamination and dismantlement will provide mortgage reduction and address human health and safety issues related to clean up activities in highly radioactive environments.

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

III. Performance Summary - Accomplishments - (cont'd)

FY 1997

FY 1998

FY 1999

Deactivation and Decommissioning Focus Area - (cont'd)

Tritium-Contaminated Facility D&D - (cont'd)

Reduces costs for Mound D&D with additional deployment opportunities at other DOE sites, especially SRS.

- In FY 1998:
 - Initiate planning and coordination with the various contractors for demonstration of various remote characterization technologies.
- In FY 1999:
 - Demonstrate technologies for remote decontamination and remote dismantlement of tritium-contaminated equipment and surfaces.

Canyons Disposition Initiative

This cost-shared (with Office of Environmental Restoration, Office of Waste Management, and Office of Nuclear Materials and Stabilization) project is evaluating the feasibility of using the five chemical processing facilities (canyons) as an asset for disposal of low-level wastes instead of continuing to be a D&D mortgage liability, as part of the tri-party agreement between the DOE-RL, EPA and the State of Washington Department of Ecology. This project has the potential to save over \$1.1 billion by utilizing canyon facilities for disposal of low level wastes, instead of complete D&D of these canyon facilities. This project will feature the full-scale demonstration of 3-6 innovative technologies for remote characterization.

\$0

\$2,500

\$3,000

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

III. Performance Summary - Accomplishments - (cont'd)

FY 1997 **FY 1998** **FY 1999**

Deactivation and Decommissioning Focus Area - (cont'd)

Canyons Disposition Initiative - (cont'd)

- In FY 1998:
 - Initiate the RI/FS process .
 - Limited demonstration of remotely-delivered characterization technologies.
 - Planning for demonstration of innovative technologies.
- In FY 1999:
 - Continue demonstration of remotely-delivered characterization technologies.
 - Continue RI/FS process; the ROD will be delayed to mid-to-late FY 2000.

CP-5 Reactor D&D

This cost shared (with the EM Office of Environmental Restoration) LSDP provided cost effective methods for D&D of research reactors. It is expected that these technologies will be used for commercial reactor D&D efforts such as Commonwealth Edison's Dresden 1 facility. These types of facilities have high residual radioactivity requiring much of the work to be done remotely. Wide spread use of these technologies within DOE can lead to significant mortgage reduction when deployed at similar research reactor facilities at Idaho, Savannah River, Richland and Brookhaven National Laboratory, and to significant cost savings and risk reduction in the commercial nuclear industry for reactor D&D.

\$3,500 \$ 0 \$ 0

- In FY 1997:
 - Demonstrated full scale technologies for radiological surveying of radiation areas, treatment of contaminated fuel pool waters, size reduction of the reactor block, remote dismantlement of the reactor regulator rods and other equipment, concrete decontamination, and material handling capabilities. The work has been successfully completed and has been accepted for use at numerous DOE sites.

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

III. Performance Summary - Accomplishments - (cont'd)

Deactivation and Decommissioning Focus Area - (cont'd)

FY 1997 **FY 1998** **FY 1999**

Fernald Plant 1 D&D

This cost shared (with the EM Office of Environmental Restoration) LSDP provided cost effective methods for D&D of uranium processing facilities. Full deployment of these technologies can lead to significant mortgage reduction and enhanced safety and efficiency at the many processing facilities including Oak Ridge, Rocky Flats, and Richland and other similar facilities at Fernald. These technologies are needed to complete the cleanup at Fernald and Rocky Flats so that they can be effectively shutdown within the Draft 2006 Plan time frame.

\$3,500 \$ 0 \$ 0

- In FY 1997:
 - Full scale technologies were demonstrated for: rapid, thick metal cutting, facilitating safe insulation removal; rapid piping inspection and characterization, enabling proper disposal methods to be employed; real-time characterization of uranium contaminated surfaces; worker protection, and for disposal of high void space materials. These technologies were all compared to baseline methods, thereby allowing accurate cost and performance assessments to be developed. The planned work has been successfully completed.

Other D&D Focus Area Activities

\$13,092 \$10,985 \$ 0

- In FY 1997:
 - Demonstrated and deployed advanced personnel protective equipment to reduce worker risk in highly contaminated areas. Developed and tested at full scale an electro-refining process for the decontamination of nickel. Developed characterization technologies for pre-D&D and post-D&D facility monitoring. Developed real time mapping technology. Developed and tested dust and debris removal for enhanced worker safety.

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

III. Performance Summary - Accomplishments - (cont'd)

FY 1997

FY 1998

FY 1999

Deactivation and Decommissioning Focus Area - (cont'd)

Other D&D Focus Area Activities - (cont'd)

- FY 1997: (cont'd)
 - Developed remotely operated mechanical cutting tools for dismantlement.
Developed and tested a dry-ice blasting robot for concrete decontamination.
- In FY 1998:
 - Complete development and testing of an electro-refining process for the decontamination of nickel; complete development of characterization technologies for pre-D&D and post-D&D facility monitoring; deploy real time mapping technology; and deploy remotely operated mechanical cutting tools for dismantlement.
- In FY 1999:
 - No activity.

Total, Deactivation and Decommissioning Focus Area

\$30,192

\$28,485

\$20,845

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

III. Performance Summary - Accomplishments - (cont'd)

Deactivation and Decommissioning Focus Area - (cont'd)

FY 1997 **FY 1998** **FY 1999**

Explanation of Changes from FY 1998 to FY 1999:

The funding decrease from FY 1998 to FY 1999 for the Deactivation and Decommissioning Focus Area represents a net change due to:

Production Reactors: Completion of the Production Reactors D&D LSDP	- \$5,000
Highly Enriched Uranium Contaminated Facility D&D: Increase supports full development and demonstration phases of HEU Contaminated Facility D&D LSDP.	+ \$1,000
Transuranic Contaminated Materials: Increase supports full development and demonstration phases of the Transuranic Contaminated Materials and Waste Disposition LSDP.	+ \$3,500
Tritium Contaminated Facility: Increase supports full development and demonstration phases of Tritium-Contaminated Facility D&D LSDP.	+ \$3,345
Canyon Disposition Initiative: Increase supports full development and demonstration phases of the Canyon Disposition Initiative	+ \$500
Other D&D Activities: Completion of development and testing of the electro-refining process for the decontamination of nickel and characterization technologies for pre-D&D and post-D&D facility monitoring	- \$10,985
Total Funding Change, Deactivation & Decommissioning	- \$7,640

SCIENCE AND TECHNOLOGY DEVELOPMENT

TECHNOLOGY DEVELOPMENT AND DEPLOYMENT

PLUTONIUM STABILIZATION AND DISPOSITION FOCUS AREA

I. Mission, Supporting Goals, and Objectives

The Secretary of Energy has made commitments to the Defense Nuclear Facility Safety Board (DNFSB) in response to DNFSB Recommendation 94-1 that the Department will develop and deploy technologies to stabilize and dispose of plutonium and plutonium residues. More than 20 tons of plutonium and 170 tons of plutonium residues remain in the weapons manufacturing “pipeline” at several DOE sites such as Rocky Flats, Hanford, and Savannah River. Plutonium and plutonium residues will continue to pose imminent environmental, safety, and health hazards until they are incorporated into stable, safeguards-compatible waste forms and final disposition is completed. Similar quantities of unstabilized material exist in the former Soviet Union. The Plutonium Stabilization and Disposition Focus Area (PFA) will design appropriate waste form technologies, devise packaging, and support development of necessary transportation, storage, surveillance, and monitoring technologies. Within the funding provided, this Focus Area will assist in the deployment of alternative technologies at individual sites to reduce risk and cost, and accelerate the cleanup at those sites.

II. Funding Schedule

<u>Program Activity</u>	<u>FY 1997</u>	<u>FY 1998</u>	<u>FY 1999</u>	<u>\$ Change</u>	<u>% Change</u>
Plutonium Stabilization and Disposition					
Focus Area	<u>\$ 0</u>	<u>\$ 0</u>	<u>\$4,935</u>	<u>+\$4,935</u>	<u>N/A</u>
Total, Plutonium Stabilization					
and Disposition Focus Area	<u>\$ 0</u>	<u>\$ 0</u>	<u>\$4,935</u>	<u>+\$4,935</u>	<u>N/A</u>

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

III. Performance Summary - Accomplishments

Plutonium Stabilization and Disposition Focus Area - (cont'd)

FY 1997

FY 1998

FY 1999

Stabilization and Disposition of Plutonium

This effort represents an effective “new start” for the OST through the transfer and heightened focus on work which has previously (prior to FY 1999) been funded through the EM Office of Nuclear Materials and Facilities Stabilization. The DNFSB has recognized the significant contamination, safeguards, nuclear criticality, and worker risk posed by failure to transform long-lived weapons isotopes into a stable and manageable form. By building on past accomplishments and consolidating current technology development activities related to plutonium, the PFA will provide higher priority, cost-effective management necessary to meet Secretarial commitments to the DNFSB.

\$ 0

\$ 0

\$4,935

- In FY 1999:
 - Stabilization:
 - Develop processes to stabilize Pu-contaminated salts and Pu-contaminated ash using low temperature processes, and non-intrusive measurement and monitoring technology to verify the stabilization processes.
 - Integrate cost effective technologies for stabilizing U233 and miscellaneous Pu-bearing waste streams.
 - Reduce overall R&D costs by collaborating with Russian Institutes to acquire technologies developed by Russian scientists.
 - Disposition:
 - Develop technologies to fabricate plutonium residue package containers from radioactively contaminated scrap metal; and remote packaging and non-intrusive package monitoring systems.
 - Integrate the development of a single monitoring and surveillance system which satisfies both U.S. and Russian safeguards and security requirements.

III. Performance Summary - Accomplishments

FY 1998**FY 1999**

Stabilization and Disposition of Plutonium - (cont'd)

- ## Total, Plutonium Stabilization and Disposition Focus Area

\$0

\$0

\$4,935

The funding increase is due to the initiation of a new OST Focus Area which will address the stabilization and disposition of plutonium and plutonium residues across the DOE complex.

\$+4,935

\$+4,935

SCIENCE AND TECHNOLOGY DEVELOPMENT

TECHNOLOGY DEVELOPMENT AND DEPLOYMENT

UNIVERSITY PROGRAMS

I. Mission, Supporting Goals, and Objectives

Universities provide a unique opportunity to cooperate with the academic community in the development of fundamental data related to the application of technology development and the follow-up activities related to the resolution of technical issues and system optimization. Attention is given to providing credible data, from non-conflicted, recognized experts in support of activities related to the acceptance of innovative technologies by the regulators and stakeholders.

II. Funding Schedule

<u>Program Activity</u>	<u>FY 1997</u>	<u>FY 1998</u>	<u>FY 1999</u>	<u>\$ Change</u>	<u>% Change</u>
University Programs	<u>\$21,930</u>	<u>\$22,150</u>	<u>\$14,900</u>	<u>\$-7,250</u>	<u>-33%</u>
Total, University Programs	<u>\$21,930</u>	<u>\$22,150</u>	<u>\$14,900</u>	<u>\$-7,250</u>	<u>-33%</u>

III. Performance Summary - Accomplishments

	<u>FY 1997</u>	<u>FY 1998</u>	<u>FY 1999</u>
Florida State University	\$3,268	\$1,600	\$1,900

Facilitate Partnerships with Eastern and Central European Institutes for the evaluation and transfer of European environmental technologies for application to DOE problems.

- In FY 1997:
 - Established a formal relationship with an environmental institute in Poland as our central point of contact in the region. Initiated a project to remediate a refinery site in partnership with European institute.

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

III. Performance Summary - Accomplishments

FY 1997 FY 1998 FY 1999

University Programs - (cont'd)

Florida State University - (cont'd)

- In FY 1998:
 - Complete work on initial project at refinery and begin testing European phytoremediation technologies for metal removal from soils.
- In FY 1999:
 - Complete work in phytoremediation and initiate a second project for removal of metal from soils.

Mississippi State University (DIAL)

\$3,530 \$6,000 \$4,000

Continue support to the Mixed Waste Characterization, Treatment, and Disposal, the Deactivation and Decommissioning, and the Radioactive Tank Waste Remediation Focus Areas. Specifically:

- In FY 1997:
 - Developed and demonstrated various characterization tools for use in the measurement of mixed and high level waste.
- In FY 1998:
 - Continue the development of characterization tools for high level waste and initiate a program to validate performance of continuous emission monitors for Mixed Waste Thermal Treatment Systems.

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

III. Performance Summary - Accomplishments

University Programs - (cont'd)

Mississippi State University (DIAL) - (cont'd)

- In FY 1999:
 - Continue the development and testing of continuous emission monitors for thermal treatment of mixed waste and initiate the development of sensors to measure the flow characteristics of HLW in transfer pipes.

Florida International University (FIU)

FY 1997 FY 1998 FY 1999

\$5,000 \$5,150 \$5,000

Continue to support the Deactivation and Decommissioning, Mixed Waste Characterization, Treatment and Disposal, and the Radioactive Tank Waste Remediation Focus Areas. Specifically:

- In FY 1997:
 - Assisted D&D Focus Area in the planning and coordination of the Large Scale Demonstrations and provided an independent testing facility for several D&D technologies including surface cleaning and concrete recycle.
- In FY 1998:
 - Continue assistance to D&D and High-Level Waste Focus Areas. Facilitate major international D&D workshop including public and private participants.
- In FY 1999:
 - Initiate program to improve Robotic D&D equipment to perform in highly radioactive environments.

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

III. Performance Summary - Accomplishments

	<u>FY 1997</u>	<u>FY 1998</u>	<u>FY 1999</u>
<u>University Programs</u> - (cont'd)			
Medical University of South Carolina (MUSC)	\$0	\$3,000	\$0
Conduct research focusing on recognition, identification, mechanisms, quantification and prevention of adverse biological effect/human disease resulting from exposure to chemical agents in the environment.			
<ul style="list-style-type: none"> • In FY 1998: <ul style="list-style-type: none"> - Investigate toxicological and epidemiology hazards (risk) to human health as it applies to environmental exposure. • In FY 1999: <ul style="list-style-type: none"> - No activity. 			
Tulane University	\$6,000	\$2,400	\$0
Support activities to provide tools for technology evaluation to maximize assessment and management of risk reduction activities in the weapons complex. Support the Subsurface Contaminants Focus Area through the evaluations of the health of contaminated aquatic environments in the Mississippi River Basin. Specifically:			
<ul style="list-style-type: none"> • In FY 1997: <ul style="list-style-type: none"> - Conducted studies on intrinsic remediation and the effect of contamination on human health; novel modeling approaches for contaminant transport and advanced geographical information system applications. Completed draft final reports for Technical Evaluation Framework; Multimedia Model Comparison; and Risk Communication to Native American and African American Communities. 			

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

III. Performance Summary - Accomplishments

University Programs - (cont'd)

Tulane University (cont'd)

- In FY 1998:
 - Complete studies associated with this grant.

Robotics University Program

FY 1997 **FY 1998** **FY 1999**

\$4,000 \$4,000 \$4,000

Consortium of Universities: Tennessee, New Mexico, Michigan and Texas that provide broad capabilities ranging from “basic” through “applied” research in support of specific projects across the DOE complex.

- In FY 1997:
 - Developed and tested an automated robot for the characterization of radioactively contaminated floors.
- In FY 1998:
 - Support the software and equipment development for an automated system for analytical analysis of soil.
- In FY 1999:
 - Support the Deactivation and Decommissioning effort through the development of sensors and software for mapping of facilities and the remote handling of materials.

Pembroke University

\$132 \$0 \$0

Supports efforts designed to increase the number of native American and African American students matriculating into environmental science curricula, focusing on environmental research and cleanup technologies.

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

III. Performance Summary - Accomplishments

University Programs - (cont'd)

Pembroke University - (cont'd)

- In FY 1997:
 - Provided for equipment and supplies to support the academic grant.

Total, University Programs

FY 1997 FY 1998 FY 1999

\$21,930 \$22,150 \$14,900

Explanation of Funding Changes from FY 1998 to FY 1999:

Florida State University: Initiate second project for phytoremediation removal of metal from soils. +\$300

Mississippi State: Reduce effort related to the development of continuous emission monitors for thermal treatment of mixed waste. -\$2,000

Florida International University: Completed major international D&D workshop. -\$150

Medical University of South Carolina: Funding for this activity will be provided from other Environmental Management sources. -\$3,000

Tulane University: Studies associated with this grant have been completed. -\$2,400

Total Funding Change, University Programs

-\$7,250

SCIENCE AND TECHNOLOGY DEVELOPMENT

TECHNOLOGY DEVELOPMENT AND DEPLOYMENT

Idaho Technology Validation and Verification Center

I. Mission, Supporting Goals, and Objectives

In FY 1997, activities were initiated to utilize the capabilities of the Idaho National Engineering and Environmental Laboratory (INEEL) in technology validation and verification to support and enhance application and deployment of innovative EM technologies across the DOE complex. These activities will place DOE's environmental programs on a solid technical base, reduce costs, and leverage the DOE investment into broader national environmental priorities. In addition, systems engineering activities will be used in the development of disposition processes for each EM waste stream. These processes will assist EM to focus activities on accelerating cleanup needed to achieve completion/closure of sites identified in the Draft 2006 Plan; to develop alternatives to the Draft 2006 Plan baseline using innovative technologies, and to track performance of these efforts. These activities ensure that funds and resources are leveraged to maximize benefits, avoid duplication of efforts, and achieve compliance with regulatory commitments. In addition, these activities reduce cost and improve quality assurance and quality control for innovative technologies.

II. Funding Schedule

<u>Program Activity</u>	<u>FY 1997</u>	<u>FY 1998</u>	<u>FY 1999</u>	<u>\$ Change</u>	<u>% Change</u>
Idaho Technology Validation and Verification Center	<u>\$4,000</u>	<u>\$14,500</u>	<u>\$0¹</u>	<u>\$-14,500</u>	<u>N/A</u>
Total, Idaho Technology Validation and Verification Center	<u>\$4,000</u>	<u>\$14,500</u>	<u>\$0¹</u>	<u>\$-14,500</u>	<u>N/A</u>

¹ The FY 1999 request of \$13,500,000 is included within the Science and Technology Development decision unit under the Non-Defense Environmental Management Appropriation.

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

III. Performance Summary - Accomplishments:

Idaho Technology Validation and Verification Center - (cont'd)

FY 1997 **FY 1998** **FY 1999**

Validation and Verification

In FY 1997, activities related to technology validation and verification were initiated to enhance application of innovative technologies to meet DOE cleanup needs. Treatability studies and environmental modeling will be conducted to validate, verify and assess environmental data needed to design technological solutions to DOE environmental problems.

\$2,000 \$14,500 \$0¹

- In FY 1997:
 - Initiated feasibility studies and initial test bed engineering for four focused technology programs to support the technology needs of EM. The four programs are: 1) Characterization Science for Optimization of Waste Processing and Monitoring; 2) Transport Aspects of Selected Mass Transport Agents; 3) Chemistry of Environmental Surfaces; and 4) Material Dynamics.
- In FY 1998:
 - Initiate four focused technology programs to support the technology needs of EM in four key technology programs described in FY 1997.
 - Complete design and construction of a test bed for demonstration of multiple parameter metrics for site-based decision modeling.
 - The Idaho environmental simulation and modeling efforts will provide robust, modern and effective technologies for the efficient, predictive graphic depiction and visualization of environmental problems.

¹ The FY 1999 request of \$5,500,000 is included within the Science and Technology Development decision unit under the Non-Defense Environmental Management Appropriation.

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

III. Performance Summary - Accomplishments:

FY 1997

FY 1998

FY 1999

Idaho Technology Validation and Verification Center - (cont'd)

Validation and Verification - (cont'd)

- FY 1998: (cont'd)
 - Conduct environmental engineering systems and testing activities to enhance application of innovative technologies throughout the weapons complex.
 - Increase contributions in nuclear technologies and applications of nuclear technologies to weapons complex cleanup needs.
 - Pursue application of innovative technologies to meet needs of the national environmental mission.
- In FY 1999:
 - Funds requested under the EM non-defense appropriation.

Systems Engineering

Systems Engineering activities will be used in the development of disposition processes for each EM waste stream which will be used to focus EM activities needed to achieve cleanup of sites identified in the Draft 2006 Plan.

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

III. Performance Summary - Accomplishments:

	<u>FY 1997</u>	<u>FY 1998</u>	<u>FY 1999</u>
<u>Idaho Technology Validation and Verification Center</u> - (cont'd)			
Systems Engineering - (cont'd)			
These activities will examine selected innovative technology's linkage to user needs to focus on critical aspects of design to ensure smooth implementation at DOE sites; and sufficient understanding and consideration of needed data and information to define performance specifications which will reduce the costs and risks associated with EM activities and shorten schedules for cleanup.	\$2,000	\$0	\$0 ¹
<ul style="list-style-type: none"> • In FY 1997: <ul style="list-style-type: none"> - Provided a pilot systems engineering study of mixed waste treatment and disposal to demonstrate the value and applicability of complex-wide systems engineering approach. • In FY 1998: <ul style="list-style-type: none"> - Activity will be funded in the Defense EM Post-2006 Decision Unit at Idaho. • In FY 1999: <ul style="list-style-type: none"> - Funding requested under the Non-Defense EM appropriation. 			
Total, Idaho Technology Validation and Verification Center	<u>\$4,000</u>	<u>\$14,500</u>	<u>\$0</u>

¹ Funding of \$8,000,000 is included within the Science and Technology Development decision unit under the Non-Defense EM appropriation.

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

III.	<u>Performance Summary - Accomplishments:</u>	<u>FY 1997</u>	<u>FY 1998</u>	<u>FY 1999</u>
	<u>Idaho Technology Validation and Verification Center</u> - (cont'd)			
	<u>Explanation of Changes from FY 1998 to FY 1999:</u>			
	The FY 1999 budget request for this activity of \$13,500,000 is contained within the Non-Defense EM Science and Technology Development decision unit. The validation and verification activities will be supported at a lower level in FY 1999 due to the completion of design and construction of a demonstration test bed.			<u>-\$14,500</u>
	Total Funding Change, Idaho Technology Validation and Verification Center			<u>-\$14,500</u>

SCIENCE AND TECHNOLOGY DEVELOPMENT

TECHNOLOGY DEVELOPMENT AND DEPLOYMENT

WESTERN ENVIRONMENTAL TECHNOLOGY OFFICE

I. Mission, Supporting Goals, and Objectives

The DOE facility, Western Environmental Technology Office (WETO), in Butte, Montana, was privatized on September 30, 1996, when DOE entered into a five year research and development contract with Mountain States Energy (MSE) Technology Applications, Inc. This contract requires DOE funding totaling over \$57,000,000. The MSE workscope is focused on meeting the high priority technology needs associated with the Mixed Waste Characterization, Treatment and Disposal Focus Area and the Subsurface Contaminants Focus Area. In addition, to support these Focus Areas, MSE works as a validation and verification center for selected OST sponsored technology systems and has the capability to perform life cycle systems engineering analyses on innovative technology systems to maximize the chances of successful implementation and deployment of these technology systems.

II. Funding Schedule

<u>Program Activity</u>	<u>FY 1997</u>	<u>FY 1998</u>	<u>FY 1999</u>	<u>\$ Change</u>	<u>% Change</u>
Western Environmental Technology Office (WETO)	<u>\$13,463</u>	<u>\$13,363</u>	<u>\$0¹</u>	<u>\$-13,363</u>	<u>N/A</u>
Total, Western Environmental Technology Office (WETO)	<u>\$13,463</u>	<u>\$13,363</u>	<u>\$0¹</u>	<u>\$-13,363</u>	<u>N/A</u>

III. Performance Summary - Accomplishments

	<u>FY 1997</u>	<u>FY 1998</u>	<u>FY 1999</u>
Controlled Emissions Demonstration (CED)			

The objectives of the CED project are to test thermal-treatment system leading edge off-gas-treatment components and monitoring systems in order to reduce total off-gas emissions, the hazardous components of those emissions, and to reduce associated secondary off-gas waste streams.

¹ FY 1999 request of \$13,000,000 is included within the Non-Defense EM Science and Technology Development decision unit.

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

III. Performance Summary - Accomplishments

Western Environmental Technology Office - (cont'd)

Controlled Emissions Demonstration (CED) - (cont'd)

The thermal waste treatment systems are of interest to DOE and technology transfer could extend to the private sector. The thermal driver used at MSE for this project is a 6 foot plasma arc furnace. The project is expected to continue through FY 2001.

FY 1997 FY 1998 FY 1999

\$5,185 \$4,600 \$0¹

- In FY 1997:
 - A pilot-scale off-gas test loop was installed at WETO using the main plasma reactor and three off-gas emissions control systems were evaluated. In addition, the plasma torch component life extensions project was completed.
- In FY 1998:
 - Five innovative off-gas treatment systems will be installed and testing initiated, addressing difficult to remove contaminants such as mercury and nitrogen oxides. Testing of real-time monitoring systems for these contaminants was initiated.
- In FY 1999:
 - Funding requested under the EM Non-Defense appropriation.

¹ FY 1999 request of \$2,500,000 is included within the Science and Technology Development decision unit under the Non-Defense EM appropriation.

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

III. Performance Summary - Accomplishments

Western Environmental Technology Office - (cont'd)

FY 1997 FY 1998 FY 1999

Subsurface Contaminant and In Situ Remediation

Radionuclide, RCRA hazardous metals and DNAPLs are major contaminants in the soil and ground water at sites throughout the DOE complex. Project activities focus on validation and verification of containment technologies such as barriers, and in situ remediation technologies such as stabilization and bioremediation in direct support of the Subsurface Contaminants Focus Area.

\$6,730 \$7,495 \$0¹

- In FY 1997:
 - In situ reactive barrier systems were initiated at Oak Ridge and Rocky Flats; a viscous barrier and phytoremediation demonstrations were installed at Brookhaven (BNL); an in situ thin-wall grout barrier was installed and tested through an industry/government consortium at Dover Air Force Base, and an in situ solution mining technology demonstration for removal of uranium was initiated at Fernald.
- In FY 1998:
 - The reactive barrier demonstration at Oak Ridge and Rocky Flats will be completed. The viscous barrier technique used at BNL will be assessed for application at a hot site. The phytoremediation technology will be demonstrated at SRS. The third and last phase of the thin-wall grout diaphragm barrier at Dover Air Force Base will be initiated, and in situ solution mining and grout monolith stabilization completed.

¹ FY 1999 request of \$6,800,000 is included within the Science and Technology Development decision unit under the Non-Defense EM appropriation.

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

III. Performance Summary - Accomplishments

FY 1997 **FY 1998** **FY 1999**

Western Environmental Technology Office - (cont'd)

Subsurface Contaminant and In Situ Remediation (cont'd)

- In FY 1999:
 - Funding requested under the EM Non-Defense appropriation.

Engineering Analysis and Validation

Life cycle systems analysis is critically important to understanding and maximizing the chances for successful application of all treatment, remediation, and containment technology systems. This project will focus on the analysis and validation of technology systems which are ready candidates for implementation and deployment, matching of newly developed technologies with DOE urgent clean up needs to enhance deployment opportunities.

\$1,548 \$1,268 \$0¹

- In FY 1997:
 - Engineering and validation activities assisted deployment of controlled emissions and mixed waste thermal treatment technologies and subsurface containment barriers through industry/Federal consortia.
- In FY 1998:
 - Continue validation of technologies such as barriers and in situ remediation, with emphasis on partnership with the Dover Air Force Base consortium.

¹ FY 1999 request of \$3,700,000 is included within the Science and Technology Development decision unit under the Non-Defense EM appropriation.

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY DEVELOPMENT AND DEPLOYMENT - DEFENSE (cont'd)

III. Performance Summary - Accomplishments

FY 1997 **FY 1998** **FY 1999**

Western Environmental Technology Office - (cont'd)

Engineering Analysis and Validation (cont'd)

- In FY 1999:
 - Funding is requested under the EM Non-Defense appropriation.

Total, Western Environmental Technology Office

\$13,463

\$13,363

\$0

Explanation of Changes from FY 1998 to FY 1999:

The FY 1998 budget request of \$13,363,000 for WETO is contained within the Defense EM Science and Technology Development decision unit. Beginning in FY 1999, funding for WETO will be requested under the Non-Defense EM Science and Technology Development decision unit, reflecting a wider basis for innovative technology analysis and validation activities to include the entire DOE complex under the EM programmatic mission. The decrease of \$363,000 from FY 1998 to FY 1999 reflects funding requirements for the third year of the five year contract period.

-\$13,363

Total Funding Change, Western Environmental Technology Office

-\$13,363

SCIENCE AND TECHNOLOGY DEVELOPMENT

TECHNOLOGY ACCEPTANCE AND SUPPORT

TECHNOLOGY ACCEPTANCE AND SUPPORT

I. Mission, Supporting Goals, and Objectives

Actual deployment of technologies has proven to be difficult for many reasons. Technology Acceptance and Support (formerly known as Technology Systems Application in the FY 1998 Congressional Budget Request) is working to ensure that needed technologies still in development are ultimately accepted by all parties and used by the sites. This is achieved by working directly with the sites in establishing the OST program and by addressing site, regulator, and other stakeholder acceptance issues as technology development progresses. Informed acceptance and investment decisions are supported through collection of national and international program information, identification of real technology needs, peer and program reviews of our technologies and plans, strategic Draft 2006 Plan analysis for greatest mortgage and risk reduction opportunities, detailed site and technology specific applicability analysis, and life-cycle cost and benefit analysis. National regulatory acceptance is fostered by assisting joint state formulation of broadly accepted demonstration and permitting protocols which should greatly speed up multi-site technology implementations.

II. Funding Schedule

<u>Program Activity</u>	<u>FY 1997</u>	<u>FY 1998</u>	<u>FY 1999</u>	<u>\$ Change</u>	<u>% Change</u>
Technology Acceptance and Support	<u>\$43,059</u>	<u>\$12,871</u> ¹	<u>\$14,900</u>	<u>\$+2,029</u>	<u>+16%</u>
Total, Technology Acceptance and Support	<u>\$43,059</u>	<u>\$12,871</u> ¹	<u>\$14,900</u>	<u>\$+2,029</u>	<u>+16%</u>

¹ In FY 1998, an additional \$6,300,000 for technology commercialization, deployment, worker health and safety operational assessments, and cost saving activities is included within the Focus Area budgets.

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY ACCEPTANCE AND SUPPORT - DEFENSE (cont'd)

III. Performance Summary - Accomplishments

Technology Acceptance and Support - (cont'd)

FY 1997

FY 1998

FY 1999

Program Information, Review, and Analysis

Provides analysis and articulation of the national EM program to technology developers, site users, regulators, and other stakeholders to ensure OST program alignment with the Draft 2006 Plan. Independent external peer review processes and program reviews enhance acceptability of key Focus Area decisions and data. A systematic decision process ensures continued funding for technologies with documented performance as well as business, regulatory, site, and stakeholder viability. Methodologies for calculating life cycle cost savings of new technologies are provided to the Focus Areas and summary, total program level mortgage reduction projections are developed.

\$14,634

\$4,225

\$4,500

- In FY 1997:
 - Developed data collection and technology/needs matching tools on the World Wide Web and systematic decision processes to facilitate analysis and reporting of this national program. Performed independent external peer reviews and National Academy of Science program reviews to enhance validity and acceptability of key Focus Area decisions and data. Initiated life-cycle cost savings assessments for the Draft 2006 Plan mortgage reduction scenarios.
- In FY 1998:
 - Continue World Wide Web data collection and technology/needs matching analysis, and discontinue most exhibits and less effective publications.

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY ACCEPTANCE AND SUPPORT - DEFENSE (cont'd)

III. Performance Summary - Accomplishments

FY 1997

FY 1998

FY 1999

Technology Acceptance and Support - (cont'd)

Program Information, Review, and Analysis - (cont'd)

- In FY 1998: (cont'd)
 - Ensure quality of systematic decision and peer review processes. Initiate cross-EM analysis of projected life-cycle cost savings to assist selection of innovative technologies and early evaluation of EM's mortgage reduction activities for the Draft 2006 Plan.
- In FY 1999:
 - Maintain the World Wide Web data collection and technology/needs matching tools and provide enhancements as needed. Ensure quality of systematic decision and peer review processes. Continue cross-EM life-cycle cost savings assessments for the Draft 2006 Plan cleanup scenarios.

Regulatory and Site Acceptance

State acceptance is a regulatory issue. In the past, states have worked separately and have required duplicative demonstrations and inconsistent protocols to achieve permitting for local use. The states are very interested in improving in this area which, in the past, has greatly slowed down multi-site deployments. To this end, OST assists states through their Interstate Technology Regulatory Cooperation (ITRC) group in establishing verification protocols and reciprocity guidelines to expedite multi-state permitting and multi-site deployment. Site acceptance is facilitated by early clarification of site needs and linking these needs with improved technologies through the Site Technology Coordination Groups (STCGs).

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY ACCEPTANCE AND SUPPORT - DEFENSE (cont'd)

III. Performance Summary - Accomplishments

Technology Acceptance and Support - (cont'd)

FY 1997 **FY 1998** **FY 1999**

Regulatory and Site Acceptance - (cont'd)

In addition, this program brings market expertise to specific Focus Area technologies and assists these technologies in becoming commercially available and ultimately deployed at DOE cleanup sites.

\$20,800 \$7,146 \$5,400

- In FY 1997:
 - Assisted 27 states in developing verification protocols and reciprocity guidelines to expedite multi-site deployments of new technologies. Provided business and deployment assistance for technologies, focusing on regional technology partnerships, commercialization alliances, market and barrier analysis, and site-specific deployment facilitation. Assisted all STCGs in defining needs and identifying applicable technologies. The states developed 21 products focusing on assisting states in accepting technology review data from other states to avoid duplicating reviews. Specific examples include multi-state regulatory requirements for: Low-Temperature Thermal Desorption, Permeable Barrier Walls, and Soil Washing.
- In FY 1998:
 - Assist all participating states with eliminating barriers to deployment through common protocols and systems. Provide business and deployment assistance for technologies, focusing on regional technology partnerships, commercialization alliances, market and barrier analysis, and site-specific deployment facilitation.

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY ACCEPTANCE AND SUPPORT - DEFENSE (cont'd)

III. Performance Summary - Accomplishments

FY 1997

FY 1998

FY 1999

Technology Acceptance and Support - (cont'd)

Regulatory and Site Acceptance - (cont'd)

- In FY 1998: (cont'd)
 - Facilitate complex-wide STCG activities, ensuring clarification of site needs and alignment of Focus Area programs with site needs. Technology evaluation protocols will be completed with focus placed on implementation in the states to document time and cost savings gained by technology developers, users, and states.
- In FY 1999:
 - Continue to assist all participating states in eliminating acceptance barriers to deployment through common protocols and systems, and continue to clarify sites technology needs and acceptability of improved technical solutions. States will focus on further implementation of state-developed technology evaluation protocols to document time and cost savings gained by technology developers, users, and states. Facilitate site acceptance as necessary.

International Technology Coordination

Ensure continued awareness and identification of available opportunities for EM participation with the international science and technology community to access foreign environmental technologies and expertise that have application at EM sites.

\$2,799

\$1,500

\$1,500

- In FY 1997:
 - Coordinated cooperative focus area development projects with Russia, Argentina, and Poland to provide additional technical solutions to high priority EM needs.

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY ACCEPTANCE AND SUPPORT - DEFENSE (cont'd)

III. Performance Summary - Accomplishments

FY 1997

FY 1998

FY 1999

Technology Acceptance and Support - (cont'd)

International Technology Coordination - (cont'd)

- In FY 1998:
 - Continue ongoing coordination and identification of available opportunities for EM participation with the international science and technology community.
- In FY 1999:
 - Continue ongoing coordination and identification of available opportunities for EM participation with the international science and technology community.

Safety and Health Testing

Conduct worker health and safety assessments of high impact environmental technologies to enhance effectiveness and efficiency of cleanup work and to improve safety, reduce cleanup costs and worker fatigue and stress, and gain greater user and worker acceptance.

\$3,500

\$0

\$3,500

- In FY 1997:
 - Conducted safety operational assessments and provided recommendations on such technologies as the ultra high pressure water jet acting tool. Provided hazmat safety training materials.
- In FY 1998:
 - Continue to provide recommendations on OST technologies for enhancing safety, reducing fatigue and stress, greater user acceptance, efficiency, and productivity.

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY ACCEPTANCE AND SUPPORT - DEFENSE (cont'd)

III. Performance Summary - Accomplishments

Technology Acceptance and Support - (cont'd)

FY 1997 **FY 1998** **FY 1999**

Safety and Health Testing - (cont'd)

- In FY 1999:
 - Continue to provide recommendations on OST technologies for enhancing safety, reducing fatigue and stress, greater user acceptance, efficiency, and productivity.

Stakeholder Participation

Support public and Tribal stakeholder participation in Focus Area decision making processes to enhance rapid deployment of accepted, improved technologies. This program integrates stakeholder concerns in technology development planning and execution.

\$1,326 \$0 \$0

- In FY 1997:
 - Supported national Community Leaders Network stakeholder participation in Focus Area decision making processes.
- In FY 1998:
 - No activity.
- In FY 1999:
 - No activity.

Total, Technology Acceptance and Support

\$43,059 **\$12,871** **\$14,900**

SCIENCE AND TECHNOLOGY DEVELOPMENT - TECHNOLOGY ACCEPTANCE AND SUPPORT - DEFENSE (cont'd)

III. Performance Summary - Accomplishments

Technology Acceptance and Support - (cont'd)

FY 1997 **FY 1998** **FY 1999**

Explanation of Changes from FY 1998 to FY 1999:

<p>Program Information, Review and Analysis: Funding was included under the Industry Programs category for cost savings in FY 1998. Including this funding in FY 1998, there was actually a decrease in this account from FY 1998 to FY 1999. The reduction represents the reduced support required for decision and review processes which have been institutionalized.</p>	<p>+\$275</p>
<p>Regulatory and Site Acceptance: Site needs are better defined allowing for less Site Technology Coordination Group facilitation and technology specific acceptance work.</p>	<p>-\$1,746</p>
<p>Safety and Health Testing: Increased worker health and safety assessments of OST technologies. (Funding of \$2,500,000 for this activity in FY 1998 was included under the Industry Programs category).</p>	<p><u>+\$3,500</u></p>
<p>Total Funding Change, Technology Acceptance and Support</p>	<p><u>+\$2,029</u></p>

SCIENCE AND TECHNOLOGY DEVELOPMENT

TECHNOLOGY ACCEPTANCE AND SUPPORT

Small Business Innovative Research Program

I. Mission, Supporting Goals, and Objectives

Funding is requested for the Small Business Innovative Research (SBIR) assessment in accordance with Public Law 102-564, which mandates a percentage of all research and development dollars be set aside for grants to small businesses. Once funding is appropriated, it is transferred to the DOE Office of Energy Research for award and administration of grants to small businesses.

II. Funding Schedule

<u>Program Activity</u>	<u>FY 1997</u>	<u>FY 1998</u>	<u>FY 1999</u>	<u>\$ Change</u>	<u>% Change</u>
Small Business Innovative Research Program	\$ <u>0</u> ¹	\$ <u>3,800</u>	\$ <u>2,000</u>	\$ <u>-1,800</u>	<u>-47%</u>
Total, Small Business Innovative Research Program	\$ <u>0</u> ¹	\$ <u>3,800</u>	\$ <u>2,000</u>	\$ <u>-1,800</u>	<u>-47%</u>

¹ Funding of \$4,095,000 was transferred to DOE Office of Energy Research for administration of SBIR grants.

SCIENCE AND TECHNOLOGY DEVELOPMENT

SCIENCE AND RISK POLICY PROGRAM

SCIENCE

I. Mission, Supporting Goals, and Objectives

The Environmental Management Science Program is a collaborative program of the Department's Office of Environmental Management (EM) and Office of Energy Research that identifies long-term, basic science research needs and targets the research and development to EM's problems as a key to developing innovative and cost-effective cleanup methods. The importance of basic scientific research to the cleanup mission has been established in several reports, specifically the Galvin Commission report (1995) entitled "Alternative Futures for the Department of Energy National Laboratories" and the National Research Council report (1996) entitled "Improving the Environment: An Evaluation of DOE's Environmental Management Program." This competitive program has the participation of the Department's National Laboratories, other Federal laboratories, academic institutions and industrial organizations. All projects have been formally reviewed and recommended for funding by both a scientific merit peer review panel and by a panel of federal program managers reviewing the relevance of the proposed research to EM's research needs. The National Research Council gave the Environmental Management Science Program high marks in a 1997 report on the program and pointed to its value to the DOE cleanup mission. The report states that "establishment of this mission-directed basic research program is both an urgent and prudent investment for the nation." This view was supported by the Science Committee of the Environmental Management Advisory Board. In May 1997 they stated that, "... the EMSP has accomplished a great deal in the short time it has been in place, that sound procedures have been put into place, and that program results are likely to be of significant value to EM..... a well managed and adequately funded basic science program has the potential to lead to significant improvements in future risk reduction and cost and time savings"; and "The committee has reviewed progress-to-date on the EMSP and has seen a number of early program benefits, including improved understanding of EM science needs, linkage with technology needs, and expansion of the cadre of scientific personnel working on EM problems." In December 1997 the science program received notification that it would be receiving a "HAMMER" award from the Vice President's National Performance Review Team.

Site-specific research needs have been solicited through a variety of activities including workshops at Richland, Savannah River, Oak Ridge and Idaho; a complex-wide needs survey; solicitation of science research needs in support of the Draft 2006 Plan from Site Technology Coordinating Groups; and through systems engineering analysis performed by the Idaho National Environmental Engineering Laboratory.

SCIENCE AND TECHNOLOGY DEVELOPMENT - SCIENCE AND RISK POLICY PROGRAM - DEFENSE (cont'd)

Science - (cont'd)

Major areas of scientific research needs addressed by the EM Science Program Grants include:

- Advanced methods to characterize, remove, and treat high-level wastes in tanks.
- New approaches and methods for the decontamination and decommissioning of contaminated facilities and equipment.
- Ways to reduce uncertainty in the long-term containment performance of spent nuclear fuel in storage and disposal.
- Advanced methods for conversion of fissile materials to more stable forms.
- Improved scientific information for the characterization, treatment, and monitoring of mixed radioactive and hazardous materials.
- New concepts for developing suitable forms for each waste to be stored.
- Reduced scientific uncertainty in the levels of risk to human health at the end stages of cleanup efforts.

As the EM Science Program matures it will continue to fund basic research and development to address the evolving science needs of EM sites. The program intends to ensure that it is addressing the right research questions, disseminating research results, and getting the "best science" by:

- Evaluation of ongoing research.
- Communicating the nature of the program, and its research results, to as wide an audience as possible.
- Holding site-specific, and complex-wide workshops to link basic research developed within and outside the Department, with technology users, both within, and outside the Department.
- Coordinating and leveraging research efforts and capabilities with other DOE programs, other federal agencies, academia, and the private sector.

The EM Science program supports DOE's strategic goal to deliver the scientific understanding and technological innovations that are critical to the success of DOE's mission and the Nation's science base. The program directly supports the objective to develop the science that underlies DOE's long-term mission.

II. Funding Schedule

<u>Program Activity</u>	<u>FY 1997</u>	<u>FY 1998</u>	<u>FY 1999</u>	<u>\$ Change</u>	<u>% Change</u>
Science	\$48,675	\$46,110	\$31,158	\$-14,952	-32%
Small Business Innovative Research Program	<u>0</u>	<u>1,212</u>	<u>842</u>	<u>-370</u>	<u>-31%</u>
Total, Science	<u>\$48,675</u>	<u>\$47,322</u>	<u>\$32,000</u>	<u>\$-15,322</u>	<u>-32%</u>

SCIENCE AND TECHNOLOGY DEVELOPMENT - SCIENCE AND RISK POLICY PROGRAM - DEFENSE (cont'd)

III. Performance Summary - Accomplishments

FY 1997

FY 1998

FY 1999

Science - (cont'd)

FY 1996 Awards

In FY 1996, 136 three-year research projects at 52 universities, 11 Department of Energy National Laboratories and other private and public technology developers and researchers were initiated. Seventy-one of the projects focused on science needed to improve remedial action processes; 26 focus on finding better ways to treat and destroy high level radioactive waste, 23 focus on waste containing a mixture of radioactive and other hazardous materials (mixed waste); 10 focus on better understanding the health and ecological risks associated with environmental cleanup options; and the remaining 6 focus on technical problems with facility deactivation and decommissioning and spent nuclear fuel stabilization and disposal. The national laboratory research project funding is focused on problems in the areas of: subsurface contaminants (48%); radioactive tank waste (24%), mixed waste characterization, treatment, and disposal (15%), decontamination and decommissioning (4%), nuclear materials (2%), and health/ecology/risk (7%).

\$24,564

\$23,139

\$20,512

- In FY 1997:
 - Provided funds for the first full year of the three-year research projects awarded to the national laboratories. (All three years of funding for university projects and two months of funding for the national laboratories were provided in FY 1996.)

SCIENCE AND TECHNOLOGY DEVELOPMENT - SCIENCE AND RISK POLICY PROGRAM - DEFENSE (cont'd)

III. Performance Summary - Accomplishments

FY 1997

FY 1998

FY 1999

Science - (cont'd)

FY 1996 Awards - (cont'd)

- In FY 1998:
 - Provide funds for the second full year of the national laboratory research projects.
- In FY 1999:
 - Provide funds for the remaining 10 months of the national laboratory research projects.

FY 1997 Awards

In FY 1997, an additional 66 three-year research projects were initiated. Over half of the 66 award recipients are collaborative efforts among universities, laboratories and private industry. Of these projects, 28 will be led by universities; 31 by Department of Energy National Laboratories; and 7 by private industry, nonprofit research centers, and other federal laboratories. Twenty-two of the projects focus on finding better ways to treat and destroy high level radioactive waste; nine focus on waste containing a mixture of radioactive and other hazardous materials; five focus on spent nuclear fuel treatment and destruction; and six address the materials used in weapons production (nuclear materials). The remaining 24 projects deal with the science needed to improve remedial action processes, to safely carry out deactivation and decommissioning of DOE sites, and to better understand the health and ecological risks associated with environmental cleanup options.

SCIENCE AND TECHNOLOGY DEVELOPMENT - SCIENCE AND RISK POLICY PROGRAM - DEFENSE (cont'd)

III. Performance Summary - Accomplishments

Science - (cont'd)

FY 1997 Awards - (cont'd)

The research funded at the national laboratories is focused on problems in the areas of: radioactive tank waste (43%), nuclear materials (18%), subsurface contaminants (14%), decontamination and decommissioning (8%), mixed waste characterization, treatment, and disposal (4%), spent nuclear fuel (4%), and research projects supporting multiple categories (9%).

<u>FY 1997</u>	<u>FY 1998</u>	<u>FY 1999</u>
\$22,192	\$9,655	\$8,035

- In FY 1997:
 - Provided all three years of funding for university projects and one month of funding for the national laboratories.
- In FY 1998:
 - Provide funds for first full year of the three-year research projects awarded to the national laboratories.
- In FY 1999:
 - Provide funds for the second full year of the national laboratory research projects.

Integration of Research Results into the Program

Management, analysis, and integration. Success of the EM Science Program is dependent on the application of scientific results in EM Focus areas and directly in field activities, enhancing EM's ability to meet compliance requirements.

\$ 1,919	\$ 1,316	\$ 1,000
----------	----------	----------

SCIENCE AND TECHNOLOGY DEVELOPMENT - SCIENCE AND RISK POLICY PROGRAM - DEFENSE (cont'd)

III. Performance Summary - Accomplishments

FY 1997

FY 1998

FY 1999

Science - (cont'd)

Integration of Research Results into the Program - (cont'd)

- In FY 1997:
 - Supported the identification, and systematic analysis of scientific research needs required to support the Draft 2006 Plan, and the peer and relevance review the 540 proposals received in response to the request for assistance.
- In FY 1998:
 - Support the process for requesting, reviewing and awarding additional new research projects to address critical Draft 2006 Plan project needs and activities to build stronger ties between researchers and problem holders.
- In FY 1999:
 - Focus on communication of research results to problem holders using tools such as workshops, seminars, written publications and the Internet. In addition, analyses will be performed to insure that critical research needs for the program are documented and well understood.

FY 1998 Awards

FY 1998 awards will be made by September 1998 to address scientific problems associated with the decontamination and decommissioning of facilities, and the storage, treatment, and disposal of high level radioactive wastes identified through an analysis of the revised Draft 2006 Plan and critical areas not covered in the 1996 and 1997 request for assistance. Research will be selected based on the potential to remediate intractable problems and reduce outyear costs.

\$ 0

\$12,000

\$1,611

SCIENCE AND TECHNOLOGY DEVELOPMENT - SCIENCE AND RISK POLICY PROGRAM - DEFENSE (cont'd)

III. Performance Summary - Accomplishments

Science - (cont'd)

FY 1998 Awards - (cont'd)

- In FY 1998:
 - Provide funds for all three years of funding for university projects and one month of funding for the national laboratory projects.
- In FY 1999:
 - Provide funds for first year of three-year research projects awarded in September 1998 to national laboratories.

SBIR/STTR assessment on research funds in accordance with Public Law 102-564.	\$0 ¹	\$1,212	\$842
---	------------------	---------	-------

Total, Science Program	<u>\$48,675</u>	<u>\$47,322</u>	<u>\$32,000</u>
-------------------------------	------------------------	------------------------	------------------------

Explanation of Changes From FY 1998 to FY 1999:

<p><u>Science:</u> No new science research and development grants will be awarded in FY 1999. Only prior year mortgages will be funded. Some prior year obligations may be extended into FY 2000.</p>	<u>-\$15,322</u>
--	-------------------------

Total Funding Change, Science Program	<u>-\$15,322</u>
--	-------------------------

¹ Funding of \$1,325,000 was transferred to the Department's Office of Energy Research for administration of SBIR grants.

SCIENCE AND TECHNOLOGY DEVELOPMENT

SCIENCE AND RISK POLICY PROGRAM

RISK POLICY

I. Mission, Supporting Goals, and Objectives

The Environmental Management National Risk Policy Program represents a partnership between the Center for Risk Excellence, located in Chicago, and the Headquarters Risk Policy Program. The overall goal of the program is to develop and implement policy, practices, guidance, tools, technical support and training that result in credible risk-based environmental decisions, which protect human health and the environment and involve meaningful stakeholder participation. The Program develops policy, interacts with national stakeholders, responds to internal and external information requests, and represents the Department to Congress. The Department is applying a consistent, comparative, framework to the multiple types of risks and hazards present at its sites, in an attempt to balance needs and priorities across programs and sites. This rigorous approach not only uses risk to inform priorities, but also measures progress based on risk reduction over time. Examples of program activities include:

- Creating tools and training for Project Managers to ensure that they can adequately convey risk management tradeoffs to stakeholders, and reach consensus-based decisions.
- Supporting research through a Cooperative agreement with the Consortium for Risk Evaluation and Stakeholder Participation (CRESP). This consortium is a partnership between the University of Medicine and Dentistry - New Jersey and the University of Washington. These independent institutions conduct research and develop tools to help the Department further define and implement approaches for credible risk assessment, management, and communication.
- Leveraging and coordinating risk research with research supported by other organizations inside and outside the Department of Energy (National Laboratories, EPA, NIOSH, etc.)
- Providing technical support to Field elements to develop tools for implementing a credible site-specific framework for EM's risk analysis, risk management, risk communication, and priority setting initiatives.

SCIENCE AND TECHNOLOGY DEVELOPMENT - SCIENCE AND RISK POLICY PROGRAM - DEFENSE - (cont'd)

Risk Policy - (cont'd)

- Providing technical peer review and comments on scientific and technical risk materials, both internally and externally, through nationally recognized scientific and technical organizations.
- Integrating risk information into the planning process for establishing priorities among competing EM requirements, simplifying the use of risk in the budget priorities, and in facilitating the use of risk in measuring performance.

Within this framework, the program will integrate baseline information within a number of key topical risk areas and develop rosters of expertise, related materials, and action plans (with follow-ups), e.g., for facilitated enhancement of existing decision processes and information exchange with regard to critical lessons learned. This will involve coordinating experts from across the complex to develop solutions to specific risk issues, pursuant to a tiered response system that considers requests for assistance based on the urgency of the request and nature/extent of resources required. The program will support and promote the development and implementation of emerging technologies and cost-efficient, protective measures for reducing risk and mortgage costs.

The research component of the program being performed through the CRESPP organization is focused on national issues concerned with :

- public health (identifying and characterizing risks to human health and well-being),
- ecological health (characterizing target ecosystems),
- exposure assessment (linking the presence of contaminants with the endpoint),
- occupational health (developing innovative approaches to the evaluation and protection of hazardous waste workers),
- social, land use, demography, geography and economics (incorporating social cultural and economic impacts into the risk paradigm).

SCIENCE AND TECHNOLOGY DEVELOPMENT - SCIENCE AND RISK POLICY PROGRAM - DEFENSE - (cont'd)

Risk Policy - (cont'd)

This program supports DOE's strategic goal to aggressively clean up the environmental legacy associated with nuclear weapons production and civilian nuclear research and development programs, minimize future waste generation, safely manage nuclear materials, and permanently dispose of the nation's radioactive wastes. The program provides guidance and tools to assist the project managers in collection of the information that will ensure that high risk projects are prioritized and funded and that risk to workers, the public, and the environment decrease over time.

It also supports DOE's commitment to ensuring the safety and health of the DOE workforce and members of the public, and the protection of the environment in all Departmental activities.

II. Funding Schedule

<u>Program Activity</u>	<u>FY 1997</u>	<u>FY 1998</u>	<u>FY 1999</u>	<u>\$ Change</u>	<u>% Change</u>
Risk Policy	<u>\$12,124</u>	<u>\$7,000</u>	<u>\$5,000</u>	<u>\$-2,000</u>	<u>-29%</u>
Total, Risk Policy	<u>\$12,124</u>	<u>\$7,000</u>	<u>\$5,000</u>	<u>\$-2,000</u>	<u>-29%</u>

FY 1997 **FY 1998** **FY 1999**

National Risk Policy Program

The National Risk Policy Program, in partnership with the Chicago Center for Risk Excellence, develops risk-based decision making approaches, including guidance documents and metrics to measure risk reduction to meet goals established for EM under the Government Performance and Results Act and DOE strategic plan.

\$3,053 \$3,000 \$3,000

SCIENCE AND TECHNOLOGY DEVELOPMENT - SCIENCE AND RISK POLICY PROGRAM - DEFENSE - (cont'd)

III. Performance Summary - Accomplishments

Risk Policy - (cont'd)

FY 1997

FY 1998

FY 1999

National Risk Policy Program - (cont'd)

- In FY 1997:
 - Continued development of risk-based decision making approaches which includes guidance documents and metrics to measure risk reduction. Implemented national and site specific strategies to protect workers, the public and the environment. Conduct/advises upon site-specific risk investigations.
- In FY 1998:
 - Continue development of risk-based decision making approaches which includes guidance documents and metrics to measure risk reduction. Implement national and site specific strategies to protect workers, the public and the environment. Conduct/advises upon site-specific risk investigations.
- In FY 1999:
 - Continue development of risk-based decision making approaches which includes guidance documents and metrics to measure risk reduction. Implement national and site specific strategies to protect workers, the public and the environment. Conduct/advises upon site-specific risk investigations.

University of Medicine and Dentistry of New Jersey and University of Washington (CRESP) Grant

Support a cooperative agreement with CRESP (University of Medicine and Dentistry of New Jersey and University of Washington) to perform risk research and develop risk analysis tools to better understand the diverse cleanup risks found at major DOE sites such as Savannah River and Hanford.

\$7,690

\$4,000

\$2,000

III. Performance Summary - Accomplishments

FY 1999

University of Medicine and Dentistry of New Jersey and University of Washington (CRESP) Grant - (cont'd)

- ### Other Research Grants

- \$ 0

\$5,000

-\$2,000

-\$2,000